THE

ELECTRICAL REVIEW.

VOL. LXX. FEBRUARY 9, 1912. No. 1,785.

ELECTRICAL REVIEW.

Vol. LXX.] CONTENTS: February 9, 1912. [No. 1785.

	Page
The Civils and the Consulting Engineer...	201
The Telephone Service	202
A Question Important to Tramway Companies...	202
A Contract to Supply Motive Power in New South Wales ...	202
Wood and Concrete Poles in Electrical Service (*concluded*) ...	203
Railless Tramways	204
A New Electrical Ship's Telegraph Apparatus (*illus.*)... ...	205
Correspondence :—	
The Electric Vehicle	206
The Economy of Electric Cooking	207
The Electrical Profession as It Is	207
Earthed Concentric System	208
Legal	208
New Electrical Devices, Fittings and Plant (*illus.*)	209
Business Notes	210
Notes	217
City Notes	221
Stocks and Shares	227
Electric Tramway and Railway Traffic Returns	228
Share List of Electrical Companies	229
Metal Market.—Fluctuations in January	231
Construction and Characteristics of the Neon Lamp	231
Electric Power for the Panama Canal.—III. (*illus.*)	232
Proceedings of Institutions :—	
The Electrical Driving of Rolling Mills (*illus.*)	235
The British Electrical and Allied Manufacturers' Association	238
New Power Station at Bury (*illus.*)	239
New Patents Applied For, 1912	240
Abstracts of Published Specifications	240
Contractors' Column... ... Advertisement pages xxii and xxiv	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION READY NEXT WEEK.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE CIVILS AND THE CONSULTING ENGINEER.

THERE is an old proverb, generally honoured in the observance, to the effect that one should speak well of the dead; or, at the least, that no ill should be spoken of them. It is somewhat in this spirit that we again refer to the Association of Consulting Engineers, for although its death has not yet been officially announced, it has received its death blow at the hands of its friends.

Having apotheosised the Institution of Civil Engineers as the fount of honour and the custodian of all the engineering virtues, it has sought to arrogate to itself a ray of the divine effulgence and to claim a lawful kinship with the "parent Institution."

From the first, the promoters of the Association have kow-towed and pandered to the Civils, and they have made corporate membership of that Institution an essential qualification for membership of the proposed Association; although, in deference to our criticisms, this condition was for a time waived, it was subsequently restored, doubtless as an act of filial penitence in the hope of receiving the parental benediction, which, as it now appears, had been previously withheld.

"It's a wise child that knows its own father," and from the letter which we reproduce below, it is very clear that the Institution of Civil Engineers disowns all paternal responsibility in connection with the precocious youngster.

At the recent inaugural meeting of the Association a question was asked as to the attitude of the Institution, and considerable importance appeared to be attached to this. In reply to the question the chairman, Mr. Swinburne, commenced to read a letter which he had received from the Council, but, after reading the opening paragraph, he discovered that the letter was marked "private and confidential," so the contents were not made public; the chairman remarked however, that the gist of the letter was that the Institution did not quite see the necessity for the new Association. This was putting the matter somewhat more mildly than the letter warranted. Apparently the intention of the Council was to indicate as gently and as courteously as possible its disapproval of the proposals of the Association, and it was no doubt thought that in view of this opinion the matter would proceed no further.

Seeing, however, that the gentle hint conveyed in the letter was ignored, and that the promoters of the Association persevered in their attempts to form a boycotting clique, the Council of the Civils has now issued a copy of the letter to all the Corporate members of the Institution. This letter, copies of which have reached us from several sources, reads as follows :—

The Institution of Civil Engineers,
Great George Street, Westminster, S.W.

30 January, 1912.

Dear Sir,—In view of numerous inquiries addressed by members to the Council and this office as to the position of the Institution with respect to the formation of the Association of Consulting Engineers, the Council consider that it is now desirable that their views on the subject, as expressed in a letter written by their instructions in October last, should be made known to the Institution generally. The letter referred to was treated as at that time confidential to those identified with the proposal to form the Association; but for the reasons above stated the Council have directed that a copy of it (appended) should be communicated to the members.

I am, yours faithfully,

J. H. T. TUDSBERY, *Secretary.*

[*Copy of the Letter referred to.*]

A. H. Dykes, Esq.,
1, Victoria Street, S.W. 28 *October*, 1911.

Proposed Association of Consulting Engineers.

Dear Sir,—Referring to the communications received from you on behalf of the proposed Association of Consulting Engineers, and to the views expressed by members of the deputation which was received by the Council, I am desired to say that the Council have considered very carefully the proposals of the Association and the representations submitted by the deputation.

The Council are in cordial sympathy with the objects of the deputation in so far as they are directed to the maintenance of a high professional tone among engineers and to the prevention of abuses which operate to the disadvantage of engineers occupied in private practice.

The definition of a "consulting engineer" obviously presents no small difficulty, and apparently no complete conditions have been laid down, the fulfilment of which would entitle an individual to claim the distinctive title of consulting engineer which members of the Association propose to adopt.

The Council hold the view that no body or organisation can be in a position to give a better and more satisfactory professional qualification than the Institution itself; and it is obvious that, when possessed of such a qualification, any member of the Institution who duly adheres to its rules of professional conduct, should be able to exercise freely any professional engineering functions.

The Council also observe that the proposals of the Association involve the omission from the category of consulting engineers of persons who occupy at the time official positions, although they may be at the same time frequently called upon to act in a consultative capacity in engineering matters of no less importance than those dealt with by engineers who do not hold such posts.

It is thought that any step tending to exclude from advisory and consultative work engineers who hold official positions in the various branches of the profession, and whose experience may specially qualify them to give advice on matters with which they are conversant, would be an injustice to them and a serious loss to the public interest.

The Council feel obliged to express the view that, under the conditions put before them, it would be undesirable for the Institution to lend its official support to the proposed organisation.

I am, dear Sir, yours faithfully,

J. H. T. Tudsbery, *Secretary*.

This communication, then, assuredly sounds the death-knell of the Association as a responsible body, and it would be more polite than truthful to say that we regretted to have to announce its passing away. Possibly from its ashes may arise an association established on a broader basis, which shall command the confidence and support of the whole body of technical practitioners.

The Telephone Service.

Since the transfer of the National Telephone Co.'s undertaking to the Post Office, there has been a singular outburst of complaints against the service in the public Press, and it is freely asserted that it has greatly degenerated in efficiency. Specific instances of delay in connection and other faults are quoted, and a Telephone Users' Association has already been formed for the protection of the subscribers.

We have throughout consistently opposed the absorption of the company's system by the State, holding that efficiency and progress were more likely to be achieved by the former than the latter, and that the multiplication of Civil Servants was a grave error. Our attitude on this question is unchanged, but we cannot help feeling that the present agitation is grossly unfair to the Post Office. Be it remembered that the staff, the operators and the apparatus so recently taken over from the company are, with few exceptions, absolutely the same as under the old *régime*. Are we to believe that the Government service is so demoralising that within one month the system has been reduced to a state of chaos, and that the operators have become utterly indifferent to the efficient performance of their duty? Surely this is an incredible and unworthy suggestion.

We have for years used both the National Telephone Co.'s service and that of the Post Office, and while we have certainly found the former quicker and more satisfactory than the latter, we have not detected the slightest difference between the service in December and that given in January. It is no better—but it is no worse.

It is, we believe, generally admitted that State service, like municipal service, is not conducive to the display of energy and smartness on the part of the employés; we do not wish to cast aspersions on the character of a large body of our fellow-citizens, but the fact is notorious, and is the inevitable outcome of the conditions of service, in which, as a rule, reasonably good conduct and a moderate output are sufficient to enable an employé to remain on the establishment for life; but we cannot suppose that in one month the habits of years can be changed, and that the company's staff has lost its keenness so quickly. In common fairness, at least a year should be given to the Post Office to show its mettle; the present attacks can only be ascribed to political or other extraneous motives.

A Question important to Tramway Companies.

A case which involved a small sum of money, but a large and important principle, was recently decided by the Registrar of the Birmingham County Court. We are all accustomed to notices along a tramway route, "Cars stop here if required," &c. The question was:—Is the corporation or company responsible for the running the trams bound to carry out the promise conveyed by such a notice? In the case in question a Mr. Alfred Crane, who lives at Handsworth, desired to go with a party of friends to play golf. In order to get to the railway station they desired to use the Birmingham Corporation Tramways, and waited accordingly at an occasional stopping place. The tram which was due failed to stop, with the result that Mr. Crane and his friends lost their train, and were compelled to hire a wagonette, thus incurring additional expense to the amount of 18s. For this sum he brought the suit in the County Court. It appeared that on the day in question the car had been delayed owing to the road being under repair, and an inspector who was on board had told the driver to run past the spot without stopping. The Registrar gave judgment for the Corporation, saying:—"I do not think there was any obligation for the car to stop at Whitehall Road. I am quite satisfied that the inspector did what was reasonable in sending the car to the next compulsory stop. There is no liability to run to time. If there was, the liability of the Corporation through persons missing trains because a car was late would be unlimited." The decision is satisfactory for the tramway authority. It is manifest that no one responsible for the working of a tramway system could guarantee the running of cars to time, having regard to the exigencies of traffic; but the legal point, now decided by the Registrar, is that the posting of a notice in the street, and the usual practice of running cars at regular intervals or otherwise, raises no implication, and amounts to no warranty. While respecting the decision of the learned Registrar, we can see that there is a great deal to be said in support of the plaintiff's case, and tramway companies might be well advised to devote some of the advertising space on the backs of tickets to a disclaimer of all responsibility for the consequences of unpunctuality.

A Contract to Supply Motive Power in New South Wales.

It is not often that the Law Reports for New South Wales contain anything which throws light upon, or assists the interpretation of, the English law relating to electricity. In the case of The Electric Light and Power Supply Corporation, Ltd., *v.* Cormack, which was heard in the colony last year, and is now reported in Vol. XI of the New South Wales State Reports at page 350, it appeared that the defendant contracted with the plaintiffs to use their power supply for his works for two years, and not to install any other form of motive power during that period. During the two years the defendant sold his works to a company, of which he became the manager; and the company installed motive power other than that supplied by the plaintiffs. It was held that the company was guilty of no wrong in installing other motive power, and there was no reason for restraining the defendant from doing, as the servant of the company, such acts as the company might lawfully do.

WOOD AND CONCRETE POLES IN ELECTRICAL SERVICE.

By W. MANKTELOW.

(*Concluded from page* 194.)

Copper Sulphate Process (*Boucherie*).—In this process sap is expelled from the wood under high pressure, and a strong solution of copper sulphate is then injected from the end of the wood. After very extensive and prolonged trials, particularly on the Continent, this system of preservation has fallen into general disfavour. Copper sulphate is much inferior to creosote, mercuric chloride, and even zinc chloride as a germicide and fungicide; weight for weight, the copper salt is fifty times as costly and roughly half as effective as creosote. By this process, timber must be treated within a few days of its felling, and it is exceedingly difficult to work with lengths greater than 16-20 ft. The general inferiority of the protection afforded, to that given by creosote, is shown by the following official data :—

Average Life of Poles Impregnated with Copper Sulphate.

Austria—	Life in 9 districts varies from	8·9 to 21·9 years.
	Average life for whole country	12·8 ,,
Germany—	,, ,, ,, ,,	14·5 ,,
France & Holland	,, ,, ,, ,,	15·0 ,,

Corrosive Sublimate Process (*Kyan*).—Protection here depends upon the formation of a very stable substance by the interaction of a weak mercuric chloride solution with the albumen of the wood treated. A solution of corrosive sublimate in water (1 lb. of sublimate to 10-15 gallons of water), is placed in a wooden vat so built that no metallic parts can come into contact with the solution. Though one of the earliest protective processes evolved (patented 1832), this system has proved very effective, and, under favourable circumstances, is a close rival to creosote (Table III). A serious disadvantage is the possibility of surplus sublimate being washed out by rain, thus endangering the purity of well water in the neighbourhood besides reducing the efficacy of the pole protection.

Zinc Chloride Process (*Burnett*).—Consists in forcing an aqueous solution of zinc chloride into the pores of the wood, under considerable pressure. This salt is a good germicide and exerts a considerable waterproofing action; its use will double the life of most pole timbers (see Table III.)

With the object of preventing the leaching out of zinc chloride from the treated timber, *Rutgers* has introduced a modification of the original Burnett process, in which an emulsion of zinc chloride and creosote oil is injected under pressure, being meanwhile kept in uniform mixture by a centrifugal pump. The theory of the process is that the oil should remain in the surface pores, there forming a waterproof coating. There seems great difficulty in securing sufficient penetration of the emulsion, and the process has so far had but limited application.

Miscellaneous Impregnating Processes.—Among the older processes may be noted Blythe's (in which crude carbolic acid is forced into the dried timber), and a process which simply exposes the wood to live steam at about 200 lb. per sq. in. Under the combined influence of heat and pressure, the sap in the wood is chemically changed, and acquires a certain preservative value.

The Austrian Postal and Telegraph Bureau claimed to have secured results equal to, or better than, those given by creosote by treating pine fir and spruce poles with acidic zinc fluoride (ZnF_2 2HF). Favourable reports are also current respecting the value of "bellite" (sodium fluoride + dinitrophenol + aniline oil) as an impregnator.

Cost of Treatment.—The data shown in Table III are compiled from exhaustive reports by the German postal authorities and various American bodies; though actual costs vary considerably with locality, soil and climate, the relative values shown are representative.

With these figures may be compared the experience of a large American traction company concerning the treatment of track ties (which are subject to much the same conditions as pole butts). The lives reached by zinc chloride and creosote treatment, and the relative costs of these processes, were as follows:—

	Average life.	Relative cost.
Untreated	5 years	1·00
Zinc chloride	11 ,,	1·20
Creosote	16 ,,	1·53

The cost of creosoted southern pine poles to the Birmingham Railway Light and Power Co. during 1910, was :—

Length.	Top diameter.	Cost per pole.
30 ft.	8 in.	27s. 10d.
30 ft.	10 in.	33s. 2d.
30 ft.	13 in.	45s. 5d.
35 ft.	8 in.	31s. 5d.
35 ft.	10 in.	39s. 7d.

(The average cost per pole for 180,000 untreated pine poles of various lengths used in the U.S.A. during 1909 was 11s. 7d.)

Concrete Poles.

In the construction of these poles, from 4 to 12 reinforcing members are fixed symmetrically in a horizontal wooden or metallic mould to form a skeleton round which a suitable concrete mixture is then well tamped. The most common pole sections are circular, square and hexagonal, and it is usual to taper the poles at the rate of 1 in from 100 to 200, (1 in 120 is very common). By casting the pole with a central tunnel, an improved utilisation of material is secured, and a very convenient duct is provided in which to carry electrical conductors away from all risk of mechanical or climatic damage.

A suitable concrete mixture is one part of cement to two of sand and three or four of crushed marble, limestone or other aggregate (in $\frac{1}{4}$ in. to $\frac{1}{2}$ in. pieces). As reinforcement, $\frac{1}{4}$ in. to $\frac{3}{4}$ in. steel rods or bars may be employed. These should *never* be oiled or painted, as has been suggested by some misguided persons; such preliminary protection is quite unnecessary, and merely reduces the bond between the concrete and the steel from 300-800 lb. per sq. in. to 10-100 lb. per sq. in., *i.e.*, to a negligible value. To increase the total cohesion between the concrete and the steel rods, the latter may be twisted. Excellent results have been secured in Oklahoma by reinforcing concrete distribution line poles with 12 $\frac{1}{4}$-in. twisted bars, each placed under 11,000 lb. tension till the concrete has set thoroughly.

TABLE IV.—American Concrete Poles (cf. Table I).

Purpose.	No. used.	Length ft.	Diameter. Base.	Diameter. Top.	Section.	Weight lb.	Cost per pole
Tungsten lamps	—	12	—	—	Circular Hollow	—	16s.
,, ,,	—	25	8 in.	5 in.	Square	1,185	30s.
,, ,,	—	35	11 in.	7 in.	Circular	—	34s.
,, ,,	—	35	14 in.	6 in.	Square	2,500	60s.
Heavy 'graph and 'phone	200	35	Taper 1/120		Sq. Chamfered	5,300	—
	—	65	Taper 1/120		Sq. Chamfered	17,300	—
Transmission line	1,000	35	16 in.	7 in.	Hexagonal 9 in. to 2 in. centre hole.	2,000	34s.
	—	25	—	—		—	24s.

The moulds or "forms" used (which are, of course, in two parts) may be of wood or $\frac{1}{4}$-in. galvanised iron, with stiffeners at intervals. If it is desired to cast hollow poles, a tapered, preferably telescopic, core piece must be used, and this must be removed directly the surrounding concrete will bear its own weight; otherwise it may be impossible to release it later. The number of cores required is only half the number of forms in use.

The "walls" of hollow poles should be at least 2-3 in. thick, and, in any case, the reinforcing steel should at no point be covered with less than 1 in. of concrete. A considerable economy may be realised by casting such bolt holes as may be required for attachments to the pole, during the manufacture of the latter; ragged bolts, and even cross-arm structures (galvanised or plain rolled sections) can be cast in the pole at negligible cost.

Costs and Erection.—According to size and design, the cost of a pair of "forms" may range from £9 to £20. A gang of five men working on 12-16 forms should make 6-8 poles per day. The poles "set" in the moulds for two days, and, after lying for a further four days, they are seasoned for

not less than ten days before use; a longer seasoning period is very desirable. Strengthening of the pole with age goes on for a very long time, poles which have been in use for some years being considerably stronger than those newly erected.

The erection of concrete poles is effected by the same means as are employed for wooden poles. Main strength alone suffices for the smaller sizes, but a derrick is necessary for larger poles. From 5 to 7 ft. of the pole-butt is buried according to the nature of the foundation; in marshy districts, a deeper submersion may be necessary, and, in such a case, it is desirable to brace the pole to a creosoted rough timber foundation raft or grill (from 5 to 8 ft. sq.), placed about 5 ft. below ground level; the pole may penetrate this grill to any desired depth, and the footing should be filled in with rock and clay. A span of 100 to 150 ft. is suitable for small poles, rising to 200, 300, or even 500, ft. on heavy line and high-tension transmission routes.

Owing to their weight and indivisibility, concrete poles should be built as near as possible to the site of their utilisation.

Some idea of the weight and cost of concrete poles for various purposes may be gleaned from Table IV summarising the equipment used in a number of American towns where this type of pole has been more or less widely adopted; it is interesting to note that in Oklahoma, concrete poles for ordinary central station distribution service have been adopted as standard, after careful trials extending over the past four years.

The weight of reinforced concrete, as used in the present service, varies from 100 to 160 lb. per cb. ft., the corresponding weights of various timbers being :—

Fir, red larch, pine	30—42 lb. per cb. ft.
White cedar, new	39 ,,
Ditto, seasoned one year ...	25 ,,
Chestnut	34—43 ,,
Oak	50—60 ,,

The initial outlay on reinforced concrete poles of the class here considered, usually lies between 1s. and 2s. per ft. of length, and averages 1s. 3d. per ft. (U.S.A. values, since little work has yet been done in England in this direction). Now, the mean price of cedar poles in the States was 7s. 8d. each in 1909 (see Table I)—*i.e.*, about 4d. per ft., assuming a mean length of 25 ft. Thus the cost of concrete poles appears to be three or four times as great as that of wooden poles, but it must be remembered that, in this comparison, the concrete poles are artistic products, ready for immediate erection in any surroundings and provided with all the necessary attachment sockets, bolts, &c., whereas the wooden poles are as delivered untreated from the timber yard. Much lower relative costs of concrete poles are claimed by some American makers, but it is not clear, in such cases, to what stage of the manufacture the estimates refer. Taking the overall cost from raw material to finished pole placed in service, it appears that concrete construction is 50—100 per cent. more costly than wood, but the additional outlay is justified by the more pleasing result and by the negligible cost of attending to and repairing the concrete poles. No estimate can yet be made of the life of well-made reinforced concrete poles, but the demolition of certain poles which had been in use for seven years showed no trace of surface or internal deterioration or moisture infiltration at any point.

Briefly reviewing the advantages and disadvantages of reinforced concrete poles—for telegraph and telephone lines, central station distribution lines, lamp-posts and trolley-poles—as apparent from the present state of their development, we may say that :—

Reinforced concrete poles are applicable to any special requirements, mechanical or architectural. They are dear and heavy, but they can be built as near as desired to the site of the erection, and being practically everlasting, their net annual cost is probably less than that of wooden poles. For a number of years the strength of the pole actually increases, and should failure occur at any time, the pole will rarely actually fall. A surprising degree of flexibility is attainable. Thus, a certain type of hollow pole, 30 ft. long, tapering from 16 in. to 7 in. diameter and having $2\frac{3}{4}$-in. walls and 12 $\frac{1}{4}$-in. twisted bars as reinforcement, gave $2\frac{1}{2}$ ft. deflection without sustaining injury, when subjected to 1,500 lb. lateral top pull.

In short, reinforced concrete construction affords an excellent and economical substitute for wood in every pole service to which the latter is at present applied, but the concrete must at no point be expected to act as an electrical insulator or the reinforcing bars will be speedily destroyed and the entire replacement of the pole will be necessary.

RAILLESS TRAMWAYS.

[FROM A LEGAL CONTRIBUTOR.]

In view of the interest that is being taken in so many parts of the kingdom in railless "tramways," consideration may be given to the legality of this form of locomotion. Could it be established without the sanction of an Act of Parliament?

A moment's reflection will show that this particular form of "tramway"—one adopts the word for want of a better—is wholly different from that with which we are generally familiar. In the first place, it need involve no interference with the surface of the street—a matter of importance both from the legal and the practical point of view. In law the rights of a highway authority are such as to enable that body to prevent any person laying tramlines in a roadway, because the works must inevitably involve interference with traffic. Again, in the case of an ordinary electric tramway worked on the overhead system which involved the use of poles embedded in the footway, it is clear that such poles would interfere with the use of the street for vehicular or foot traffic, and would be prevented by the Courts at the suit of the local authority. It is, however, important to remember that the overhead part of an electric tramway system may conceivably be erected, and be allowed to remain in position, without involving any interference with the rights of persons using the road in the ordinary way. The soil of a highway belongs to each owner of the soil on either side *usque ad medium filum viae*, and each such owner is entitled to make use of his property as he chooses, provided he does not interfere with the right of the public to pass and repass along the road. In the enjoyment of his right he would be at liberty to allow wires to be suspended over his freehold. Cross wires, which at the present time are often used for suspending trolley wires, might be affixed to the walls of adjoining houses or to poles in the gardens of the frontagers. By this means the trolley wires could be suspended over the highway without any interference, temporary or permanent, with the traffic passing beneath. Leaving out of consideration the question of feeders, which might conceivably be laid on property adjoining the highway, it will be seen that, so far as the highway authority is concerned, the main part of a railless tramway could be laid by private individuals without any interference by the highway authority as such.

The fact that a highway or other local authority which does not own the soil of the roadway is unable to prohibit the erection of wires in the manner above described, is well established by numerous decisions. For instance, in Finchley Electric Light Co. *v.* Finchley Urban District Council (1903) 1 Ch. 437, the plaintiffs were a limited company supplying electricity, but without any statutory powers. The defendants cut the wires and threatened to cut any wires which the plaintiffs should carry over any street within their district. Upon their bringing an action for an injunction and damages, it was held that the local authority had no right to interfere. No statute since passed has modified the rigour of this decision.

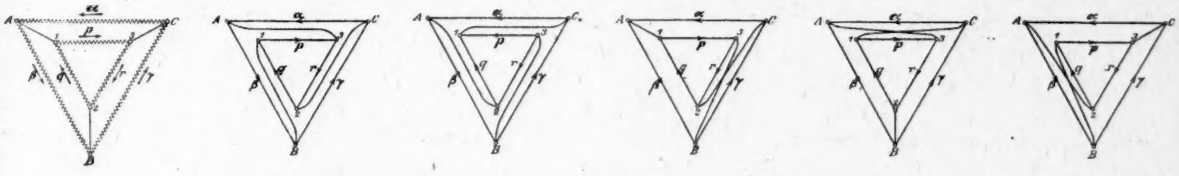
So long as the regulations of a local authority made pursuant to the Public Health Acts Amendment Act, 1890, as to overhead wires, the requirements of the Postmaster-General for the protection of telegraph and telephone wires, and the Regulations of the Board of Trade, made pursuant to the Electric Lighting Act, 1888, are complied with, it seems that the overhead part of a railless tramway system could be set up without any special Act of Parliament. It has been decided, of course, that a tramway company which

lays down unauthorised lines is guilty of a trespass, and may be sued accordingly (Bideford U.D.C. *v.* Bideford and Appledore Railway (1903), 68 J.P. 123); but, as has been shown above, such interference with the surface is not absolutely necessary in the case of a railless system.

The foregoing statement of the law applies only to the case of a railless tramway proposed to be worked by a private company. A municipality could not expend any part of the ratepayers' money in promoting a railless scheme. Nor, indeed, would the establishment of such a system be very feasible without the consent and co-operation of the local authority.

A NEW ELECTRICAL SHIP'S TELEGRAPH APPARATUS.

The electric transmission of signals is in widespread use on war ships as well as merchant ships, in railway and mining work, in electric generating stations and in many similar situations. It is generally worked by direct current, but many cases occur in which the use of alternating current would be a convenience, and the following apparatus, due to Herr Carl Meyer, of Hamburg, enables this to be done, and is said to form a more certain and quick transmission scheme than those hitherto used. The arrangement* is based on the same principle as that of the ordinary rotary synchroniser, viz., the interaction between the rotor and stator of an induction motor in which both rotor and stator are supplied from outside with independent currents of the same frequency.



Figs. 1—6.—Connections of Controller Type of Apparatus.

If, for instance, an induction motor is constructed with an ordinary three-phase stator connected to a three-phase supply and with a rotor carrying a single coil supplied from one phase of the same supply, the rotor, if left free to move, will automatically set itself in such a position that at the instant when the flux produced by the rotor coil is a maximum, the direction of this flux coincides with the direction occupied at that instant by the steadily rotating field set up by the stator. A pointer fixed to the rotor will, therefore, come to rest at a definite point on the periphery. If the phase relation of the rotor and stator currents is changed, for instance, by connecting the rotor to a different phase of the supply, or by inserting a choking coil in the rotor circuit, the rotor and its pointer will move into another definite position, and come to rest there again.

The receiver of the new apparatus, then, consists in principle of a small two-pole induction motor with single-phase rotor winding supplied through two flexible leads or through two collector rings.

The stator is supplied from a two or three-phase supply if this is available, or, if preferred, from a single-phase supply with the necessary phase-splitting device, as used in single-phase induction motors, for producing a rotating field. The rotor is supplied permanently from one phase of the same supply.

The transmitting device may take the form of a small drum controller, which serves to vary the connections of the stator to the supply generator. With a three-phase supply six such variations are possible, as is shown in figs. 1 to 6, where A B, B C and C A represent the supply generator windings, and 1-2, 2-3 and 3-1 represent the receiver stator windings.

* *E.T.Z.*, May 25th and June 1st, 1911.

If six positions of the indicator are insufficient, the writer shows that this number may be doubled by simply making the controller at one point reverse the connections of the receiver rotor to the supply, provided that some lag is present between the currents and the voltages of the receiver stator coils—a condition which is generally present, or can be easily arranged for artificially.

The number of positions can be still further increased by 12 or multiples of 12 by the simple device of introducing various values of inductance into the receiver rotor circuit at definite points in the rotation of the transmitting controller.

Where, however, such large numbers of positions are required a simpler arrangement is usually employed. This consists in replacing the transmitting controller by a small induction motor with single-phase rotor carrying the transmitting pointer. The stator of this transmitter is connected to the same supply as the stator of the receiver, whilst the rotor winding of the transmitter is connected electrically to the rotor winding of the receiver and supplies the latter with its working current. The transmitter rotor being held at rest at any point in its rotation is cut by the flux of the revolving field set up by its stator, and has an alternating current induced in it which reaches its maximum instantaneous value at a different instant (relatively to the supply alternations) for each position of the rotor. The transmitter is, in fact, nothing else than the well-known phase-shifting transformer. By its use, theoretically, an infinite number of indicator positions is obtainable, since the receiving rotor will move into exactly the same position in its stator as that occupied by the transmitting rotor at any given time.

The number of leads required between the transmitting and receiving stations is also reduced, but, on the other hand, the weight, cost and power consumption of the transmitter are increased, so that, unless the number of indicator positions is very large or unless the signals are to be simultaneously delivered at a large number of receiving stations, the controller type of transmitter is usually preferred.

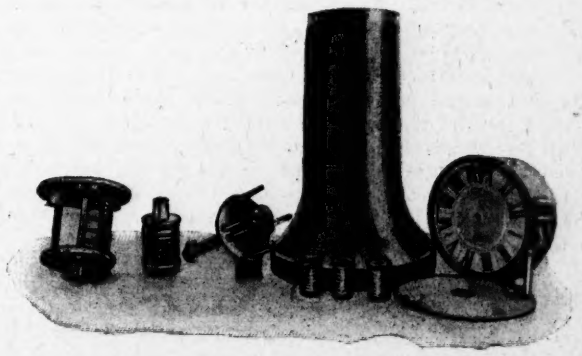


Fig. 7.—Component Parts of Combined Receiver and Transmitter.

It is common in telegraph installations to require the signals received to be repeated to the transmitting station as a check on the accuracy. For this purpose, a receiver and a transmitter are generally combined together in a single stand. Fig. 7 shows the component parts of such a combined set dismantled. In this case a controller form of transmitter has been employed and the signals are indicated on a large clock face fixed horizontally on the top of the stand.

Fig. 8 shows the connections for an installation consisting of four motor-transmitters and four receivers. A three-phase

supply is shown, and one of the three supply mains is used as a common return for all the rotor circuits, so that only a single lead per instrument is required besides the three mains running round the whole system, which would normally form part of the ordinary lighting system of the building or

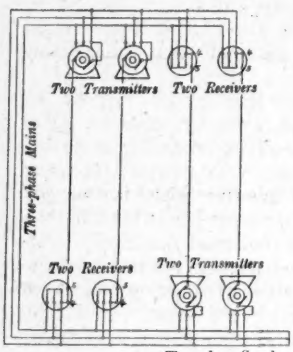


Fig. 8.

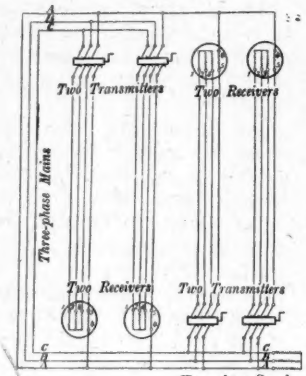


Fig. 9.

ship. Fig. 9 shows the same installation worked with controller transmitters. In this case four leads per instrument are necessary.

The apparatus has proved quick and reliable in practice, even when working over long distances, *e.g.*, 3½ miles, using only telephone wire of ·0016 sq. in. section, Variations of voltage or frequency of ±10 per cent. have no appreciable effect. The power consumed is only about 50 watts.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electric Vehicle.

I have read with the greatest interest the leading article in your issue of January 26th, and on behalf of my company I thank you for your thorough, yet brief, exposition of what you truly call the immense field for development offered by the electromobile.

I thoroughly appreciate the brevity with which you have touched on the field, and the method in which you have endeavoured to explain the many points which touch upon the history of the development of the electric vehicle and the handicap, both commercially and otherwise, to which the development of the electric vehicle has been subjected. I will endeavour to join forces with you on a question of brevity, and I, therefore, propose to set out certain points which may be of interest to your readers and yourselves.

I think on this first point I must regretfully join issue with you on the question of comparing the business of the electric vehicle here with that of the States. Most certainly is the electric vehicle widely adopted in the States, but the reasons for its adoption in the States to a much greater extent *pro rata* than in Great Britain, are, I think, obvious.

Companies which originated electrically propelled vehicles in England, did so only half-heartedly—they did not do it with the whole-hearted endeavour which accompanied such propositions in the States. Here they seemed to be originated merely with a view to gathering in public money, and not with even a substratum of idea behind the endeavour with any initial belief in the eventual success of the ventures.

Their faith in the electric vehicle companies they produced, was only a temporary faith, and as a temporary faith was bound to fail; to put the matter in a nutshell, the United States of America knowing and proclaiming their modern and up-to-date methods, believed whole-heartedly in electric traction. Here, our faith in electricity, as our faith in everything else modern and novel, is only feeble. It is with that lack of faith that the electric vehicle has had to contend throughout the course of its existence. In your article you have used facts—undeniable facts—as to the number of electric vehicles used in the States, and here I would again respectfully join issue with you. You use the word "electromobiles," may I point out that the term "electromobile" over here is generally and consistently held to apply only to the private electric brougham which this company hires out. Now in this country I think I may say without fear of contradiction that the Electromobile Co. of 7, Hertford Street, Mayfair, holds sway in the field of hiring out private electrically-propelled carriages known as "electromobiles."

At first we lived through a period of initial success, and then came a severe struggle, due, I think, to the fact that at the period of which I speak, the electric vehicle was serving no purpose of financial increment to other industrial communities of this country. I will put the matter as briefly, and bluntly, as possible. For one concrete instance, the electrically propelled vehicle was not adequate in supplying the needs of the advertising press. The electrically propelled vehicle was stated to be considered as not proportionately playing its part in the advancement, industrially and technically, of self-propelled vehicles; therefore the motor industry had no use for the electrically-propelled vehicle in this country. I was not personally at that time interested in the electrical industry. I was serving a very useful apprenticeship indeed under the directorship of Messrs. S. F. Edge, Ltd., and was chiefly concerned in petrol-propelled vehicles, but I studied with interest at that period the time of stress through which the electric vehicle passed. I think no one will join issue with me if I say definitely that the only company concerned in the business of the hiring out of electric-propelled vehicles which passed successfully through that period, was the Electromobile Co., Ltd.; and that is the position to-day. Before I deal further with your report, I think I ought to justify my writing at such length, and my case is this. This company owns in the centre of Mayfair, in the metropolis of London, one of the largest garages in Great Britain. It occupies 55,000 ft. of space. Every day in and out of the garage pass over 100 electrically-propelled vehicles. We employ more than 300 people, who are employed solely with the electrically-propelled vehicles. Our current consumption for over nine years has exceeded 5 million units. And all this, I think, gives us the right to discuss the problem of electric traction, because if electric traction dies, it dies hard; in fact, it would be almost fairer to say it is an industry temporarily stifled, and we say this with the certain knowledge that electricity as a motive power is bound to come. The petrol vehicle owes its initial power and introduction to electricity. The aeroplane owes its initial power of propulsion equally to electricity. Most of the modern developments, including wireless telegraphy, are based simply and solely on electricity.

You speak in your article of vast possibilities to be achieved and successes already achieved. You speak certainly of the United States of America, but what the United States of America already realise to a limited extent, Great Britain will, in course of time, realise to an even greater extent. In this industry, as in practically every other industry in its initial developments, Great Britain is behind, but when it has proved its worth, Great Britain is always to the fore.

Once again I join issue with you. You ask with regard to this industry, "What are we doing?" You answer, "Nothing." You state that the electrical enterprise in this country has been one continual record of distinct failure. With this latter statement I can hardly agree. I can only tell you that all we are giving you are hard facts. I believe, rightly or wrongly, that this company represents the general enterprise you mention, which—however it has lacked support in the past—will not lack support in the future. And I tell you this with the more assurance, because in the past few months we have for the first time for years surpassed the turn-over in the hiring of electric carriages which, in the initial years, was considerable. This company, for some time now has determined to retrieve the electric hiring business. It realised that if the electric hiring business was to be saved, or to be revived as an industrial concern, and by that I mean a profitable concern, this company surely

stood the best chance of success; it had the field left practically to itself. It had a fleet of carriages which you yourself describe as second to none—as you say, our lead storage batteries are as good as any made elsewhere—as you say again, our cars are unexcelled—as you say, nowhere in the world is electrical energy so cheaply available as in this country, and in all this you are irrefutably correct, and I make no excuse for giving you our company as a practical instance of what can be done in electrical hire. We have passed through our bad time; we hope to be opening out in our time of prosperity.

With regard to any company which opens up the field of electric traction, we are only too pleased to be of use and service. The more companies running electrically-propelled vehicles, the better we shall be pleased.

Briefly, there is a certain class which has decreed that for certain uses—and essential uses at that—the electrically-propelled vehicle is ideal. In that direction it has the assent of the Automobile Club, which decided years ago that the "electromobile" was the *perfect town carriage*, when it awarded it the gold medal from every possible point of view which went to make up the perfect town carriage—for ease in starting, for ease in manipulation, for absolute silence, for cleanliness and reliability. With all that behind us, surely we have every reason to believe with you that electric road vehicles will not fail here, and that we may think that this big business, with the livelihoods of hundreds of men behind us, will not fail in reviving what in time must be one of the best industries of this country.

I would like to conclude this already lengthy letter here, but for the fact that I have not touched upon the electric commercial vehicle. I think it is hardly reasonable to compare the difference between electric *wagons* here and those obtaining in the States. In the cities of the United States of America the electrically-propelled vehicle works in a circumscribed area which does not obtain here. Our centres of industry here in our big towns have larger radii. The roads in the cities of America are circumscribed simply by the fact that the roads outside its cities are such that heavily-laden "trucks" could not venture to use them. In this country the services of our roads present no such limitations. For this reason I think that the heavily-laden commercial vehicles fail, and the work must be at present left to the petrol-propelled wagon, and I say this whilst yielding nothing to, but claiming everything in advance of, the petrol vehicles in everything in respect of town use. By "town use" we do not mean to limit the field purely to pleasure vehicles. Our City electric ambulances give—have given for years past—and will continue to give, yeoman service to the City of London.

Obviously, for such a service, where reliability, smoothness, silence, and essential ease of manipulation, constitute the vital requirements, the electric vehicle cannot be surpassed. Finally, we claim the electric brougham to be the perfect town carriage for use for shopping, or in the park, or balls, or functions in town; and in that direction alone there is a sufficient field in the many towns in Great Britain or in the Metropolis alone for a tremendous industry. We rely to no extent on the light, and in our opinion inadequate, American "run-about," which alone enables those abroad to claim excessive mileage, with batteries unsuited to any carriages except such "run-abouts," which are totally unsuited to our conditions and requirements.

We build in Great Britain, with British machinery and British workmen, carriages which comply with British requirements.

The Electromobile Co., Ltd.,

S. Janson, *Manager and Secretary.*

London, W., *February 2nd*, 1912.

[Our correspondent agrees with us that the development of the electric vehicle in this country has been hampered by the promotion of unsound ventures for the purpose of extracting money from the pockets of the public rather than genuine industrial enterprise. As regards the word "electromobile," while we acknowledge the value of the excellent work done by the Electromobile Co., we must point out that the Courts have ruled that the word is not specific, but generic, and therefore cannot be restricted to any particular class or make of electric vehicle. We do not quite follow Mr. Janson's explanation of the difficulties met with by the electric automobile, but are very glad to learn that his company has over 100 electromobiles in daily service. We welcome also our correspondent's remarks concerning the multiplication of electric vehicle companies; he is perfectly correct in believing, as we gather he does, that this would hasten the development of the industry, and would materially benefit his own company in the long run.

Turning to the commercial electric vehicle, we did not compare its development here with that to which it has attained in the United States, for the simple reason that here it is non-existent, and therefore cannot be compared with anything. But we cannot agree that it has no chance of development here. There is no difficulty in equipping such a vehicle for a 40-mile run, which is sufficient even for so large an area as that of the Metropolis, with few exceptions, and our excellent roads afford every opportunity for success to be achieved—when the problem is attacked with energy and determination.—Eds. E.R.]

The Economy of Electric Cooking.

I think that Mr. Borlase Matthews has done a real service to electric cooking by his instructive letter in your issue of February 2nd. In my opinion, Mr. Allingham misses the point when he says that his meat is not dried up or toughened when cooked by gas or coal, and that, therefore, electricity cannot claim superiority over gas and coal in this respect.

Where electricity beats gas and coal is in the fact (pointed out by Mr. Borlase Matthews) that an electric oven "provides that essential uniformity even *under the hands of an unskilled cook*." The italics are mine. It is just the "human element" which makes all the difference between having the meat "juicy and succulent" or "dried up and toughened" when gas or coal is used. In electrical cooking, the "human element" plays a far less important part, and as it is the experience, I believe, of most housekeepers (I use the word in its broadest sense) that a good cook is a *rara avis*, the meat is much more likely to be "juicy and succulent" when cooked by electricity than by gas or coal. Human nature being what it is, the above feature of electrical cooking is, to my mind, a very valuable one, and should be emphasised when dealing with this subject.

With reference to "F. R. C.'s" letter, I do not consider that Mr. Good was unduly optimistic. In my opinion, one of the causes of the present unsatisfactory state of the electrical industry is the pessimistic and "can't be done" attitude adopted by "F. R. C.," which seems somewhat prevalent among electrical men. To borrow Mr. Good's metaphor, if electricity can't go the "whole hog" in dealing with the heating and cooking arrangement of a house, let electric power be used where it is admittedly superior to anything else, and where the extra cost is worth incurring.

The idea seems to be abroad that every mortal thing which can be done by electricity in a house must be accomplished by this means. "Half a loaf is better than no bread."

In conclusion, what the electrical industry needs (as, indeed, this old country as a whole requires) is men with more "grit" and greater business capacity.

Christopher Silver.

Faraday House.

The Electrical Profession as It Is.

Your correspondent who seeks obscurity behind the *nom de plume* of "Diogenes," is apparently an exceedingly accomplished individual in his own estimation; at least, the heartrending wail which is manifest throughout his letter indicates self-consciousness.

No doubt many berths in supply companies are filled more by influence than ability, but these companies only form a minor portion of the electrical industry, and if these brilliant shining lights referred to are really useful to their profession,

and are genuine electrical engineers, thoroughly trained and experienced, they should have no difficulty in securing a satisfactory berth in one of the innumerable sections of electrical engineering. Neither would they experience any difficulty in becoming members of the Institutions now existing, as they would not be debarred by absurd qualifications, seeing that it is only necessary to be an efficient engineer with proofs of thorough practical and technical training, and the support of members who could testify as to ability.

Of course, your correspondent must understand that the institutions referred to are not open to unemployed or unemployable; a prospective member must show proofs of being in a position of superior responsibility, this latter, no doubt, being the absurd qualification referred to.

The concluding part of his letter suggests what is wanted to elevate the profession to the high position of which it is worthy, but does so in a very vague manner, so perhaps the following will cause him to reflect, and if needed, to retreat to his primitive abode, away from the ignorant mankind who will not appreciate his talent and that of the scores of young men to whom he refers.

At the beginning of any session in a splendidly equipped technical institute in the heart of London, these glowing individuals from all branches of the profession, after enrolment, swarm into the lecture rooms and workshops, crowd round the laboratory test benches, &c. Let "Diogenes" be among them, and toward the end of the session note the attendance. He will be able to undertake any experiment on the laboratory list, being almost the sole occupant of the laboratory; at the lectures he will miss many, while some will be peacefully sleeping. If he reasons he will ask what has become of his fellow students, and will discover that they are busy in some section of the electrical profession posing as technical trained men.

Then there are builders, gasfitters, undertakers, amateurs who can fix and wire an electric bell, and other individuals, all of whom classify themselves as electrical engineers.

Here is the root of the evil, and the only remedy applicable is a standardisation or classifying of the individual in relation to the industry. This done, there would be fewer electrical engineers, and the so-called best young men would be, of necessity, in some other profession.

W. Ellerd-Styles.

London, N.E., *February 4th*, 1912.

Earthed Concentric System.

In reply to your editorial comments on my letter last week, I think it is distinctly a drawback not to be able to render a lampholder dead, especially when the supply is alternating at 220 volts, and the person changing a lamp is liable to make good earth. Unless it be necessary to effect any repair to the switch, there does not appear to be any objection to the lead up to it being alive; when necessary to do anything to the switch the lead can, of course, be made dead by taking out the fuse at the distribution box.

With regard to your criticism on the second point, I venture to think that the blowing of a fuse is quite as much an automatic indication of an earth as the lighting of a lamp, and it has the advantage that it compels attention to the matter, whereas a lighted lamp merely relieves a lazy person of the trouble of switching it on; I do not think that damage to a fuse by its blowing to cut off an earth, and so fulfil its mission in life, should be regarded as a drawback. The last sentence of your comment appears to me strongly to support my contention.

C. H. W.

A Brewer's Novel Motor-Lorry.—A novel petrol motor-lorry designed for the use of brewers was exhibited at the recent Motor-Car Exhibition in Brussels, by the Delahaye Co., of Paris. Above the platform of the lorry is mounted a rail which carries a miniature electric travelling crane. Combined with the engine of the vehicle is a small dynamo which furnishes the necessary current to operate the electric motor combined with the crane, the result being that one man is able to load and unload the lorry in a minimum of time, and with a minimum of trouble.

LEGAL.

Marconi *v.* Siemens Bros. & Co., Ltd., and Alfred Holt & Co.

On Friday, February 2nd, this action came before Lord Justice Fletcher Moulton and Lord Justice Buckley in the Appeal Court.

Mr. A. J. Walter, K.C., and Mr. A. J. Gray appeared for the plaintiffs, and Mr. Bousfield and Mr. Hume represented defendants.

Mr. Bousfield said this was an appeal from a decision of Mr. Justice Neville in Chancery refusing to order plaintiffs to deliver further and better particulars of the breaches they alleged of the patent specifications 11,575 of 1897, and particulars of the claiming clauses which they alleged were infringed. Defendants also desired further and better particulars in regard to the allegations by plaintiffs of infringement of Marconi's patent of 1900 by Messrs. Siemens offering to A. Holt & Co. a wireless apparatus for their ships. The principal patent in question was the Lodge patent 11,575 of 1897, a prolongation of which had been granted by Mr. Justice Parker last year. There were 11 claims in the 1897 patent, and Mr. Justice Parker had prolonged seven of them for a further period. What defendants wanted to know was whether the plaintiffs were suing on the old specification or on the new one. Plaintiffs said their action was based on both, and defendants wanted clear particulars, as the defences would be different in each case.

Mr. Walter said plaintiffs were suing on the specification with seven claims, and they contended that its validity dated back to the date of the original patent.

Lord Justice F. Moulton: And you allege that every one of those seven claims are infringed?

Mr. Walter: Yes.

Mr. Bousfield said his view was that plaintiffs' rights under the old and the new specification were quite different. Defendants would plead invalidity of the old specification if plaintiffs relied on that, and he understood that plaintiffs were complaining of infringements committed before the specification was amended.

Lord Justice Moulton: Mr. Walter, are you alleging infringement of the old specification before the expiration of the old patent?

Mr. Walter said he was, but only on the amended specification. There were no other claims.

Lord Justice Moulton: I think you must make that clear.

Mr. Walter said he was suing solely on the amended specification.

Lord Justice Moulton: You maintain that the amendment goes back to the date of the original specification?

Mr. Walter: Yes; and I say that under the Act I am entitled to sue on the amended specification in respect of breaches committed before the amendment was made.

Mr. Bousfield asked that plaintiffs' case should be clearly defined, as very complicated questions of law would arise, and the pleadings would be very complicated.

Lord Justice Moulton said the Court did not trouble much about pleadings in a patent action. He could draw up such pleadings without ever knowing what the patent specification was about.

Mr. Walter said he would make everything as clear as he could for his learned friend, and would put it in writing.

Mr. Bousfield expressed himself satisfied with this assurance, and the Court made certain orders expediting delivery of particulars and defence, so that there should be no undue delay in preparing for trial.

The City of London Electric Lighting Co., Ltd., *v.* E. W. Rudd, Ltd.

In the King's Bench Division last week, Mr. Justice Banks heard this action. It appeared that plaintiffs were suing for injury done to two electric lamp standards belonging to them, by motor lorries of the defendants. The accidents occurred on two different dates. The amount of the damages were agreed, the only question for his Lordship being whether the defendants were liable. The first accident was in Newgate Street, where, on February 24th last, one of defendants' motor-lorries knocked one of plaintiffs' lamp standards on one side, and the other, a similar accident, occurred on Snow Hill on June 16th.

After hearing the parties, his Lordship awarded the plaintiffs £50 damages, £20 in the case of the first accident, and £30 in the case of the second, with costs.

A 60,000-volt Railway Cable.—Two underground cables for a pressure of 60,000 volts have been laid on the German railway between Muldenstein and Bitterfeld for the supply of power to the electric railway proceeding from the latter town. As such high pressures have hitherto been exclusively used in connection with overhead lines, it is considered that the present experiments will be of particular interest in regard to the future development of electric railway working. One of the cables has aluminium for the conductors, and has been made by the Siemens-Schuckert Works, whilst the other is a copper cable made by the Felten and Guilleaume Co. The cables are laid in conduits filled with dry sand.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Arc Lamp Winch.

A simple but effective patent arc lamp winch has been introduced by The Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, W.C. It is of the direct-winding type, with removable handle, and is self-sustaining in every position, but offers no resistance to the raising or lowering of the lamp. The accompanying illustrations show the appearance and construction of the device. The automatic locking of the drum when the handle is released, or when the lamp is lowered too fast, is effected by means of two loose plates having a lateral movement along the drum spindle, which is cast with the drum itself. The outer loose plate has two inclined planes I P, upon which a steel pin P passing through the winch spindle engages. When the operator

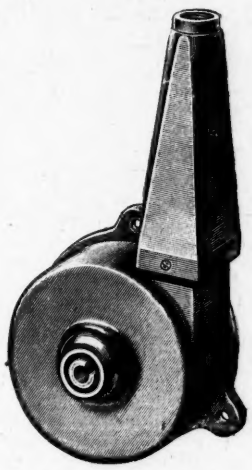


Fig. 1.—Arc Lamp Winch.

is taking the strain of the lamp which is being lowered, a lug on the key portion on the handle engages with a stop S on the outer loose plate and prevents the steel pin travelling up the inclined planes and locking the centre loose plate between itself and the end of the drum. The centre loose plate is fixed by four lugs L, fitting into recesses in the cover of the winch in such a manner that it cannot revolve. Should the handle be released, the weight of the lamp

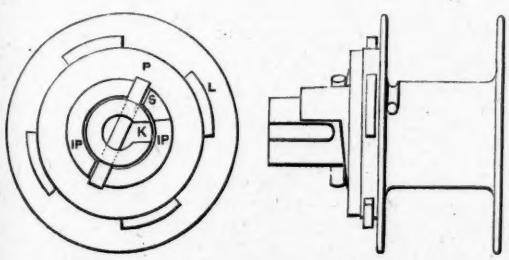


Fig. 2.—Construction of Winding Drum.

causes the pin to ride up the inclined planes on the outer loose plate and clutch the fixed centre plate, effectively locking the drum. There is no sudden jar tending to break the steel wire suspension cable which carries the lamp, and there are no pawls, ratchets or springs in the winch, which is very substantial in construction and appears to be foolproof.

Theatre Electric Sign.

In the accompanying illustration we show an interesting and, we believe, unique electric sign that has for the past five or six weeks been in position at Terry's Theatre, in the Strand. The usefulness of this sign as an advertising medium is evidenced by the maker's description of it as "The sign that stopped the traffic in the Strand." It seems to us to point the way to a very wide scope of application of the electric sign—a department in which it often has to be confessed we are so backward compared with the United States. It was erected by the Franco-British Electrical Co., Ltd., of 50, Oxford Street, London, W., and comprises their No. 1 and No. 2 "Franco" signs in connection with a "Franco" flasher. The body portion of the two clowns and tripod is made up with the firm's miniature 1-C.P. lamps and patent holders, the detail being painted in and the lamps coloured to give the requisite effect. In order to get the best effect for the heads, shaped boxes were made of leaded steel, fitted with glass cut and coloured, and illuminated inside with small bulb-lamps; the hat part is removable for the replacement of lamps. The height of the clowns is 8 ft. The balls of the throw on the tripod consist of deep cylindrical reflectors, each fitted with a single lamp. The number of wires from sign to flasher has been reduced as far as possible—namely, 50. The flasher operating the sign is a "Franco" type, size 36 in. by 18 in., operated by a $\frac{1}{10}$-H.P. motor having 52 contacts, which when working gives the operation as follows:—Lamp lights up in right clown's hand, travels rapidly across to the second clown

Fig. 3.—The "Franco" Signs.

waits an instant in hand, then extinguishes, one lamp immediatel coming alight on the tripod; this is repeated 10 times, until the whole of the lamps are alight on the table. After a slight interval the top lamp of the pyramid extinguishes, and the one becomes alight in the second clown's hand, and after an instant travels rapidly towards the sign "Cinema," appearing to illuminate a tenth part of this sign. This operation is repeated until all the balls on the table appear to have been taken and the word "Cinema" is fully alight. The whole is then extinguished and recommences. There are 427 1-C.P. lamps, 111 2-C.P. lamps, and 25 10-C.P. metallic lamps; the consumption per hour is $1\frac{3}{4}$ units.

The first day the device was alight, complaints were made by the police on account of the crowds of people in the Strand watching the sign, and in consequence for the first fortnight it was necessary to keep a man in attendance on the roof switching the sign off as soon as a crowd collected. We have no doubt that central-station engineers and all interested in electric sign work will find it convenient to make the fullest possible use of this successful experience.

Self-Oiling Plummer Blocks.

Messrs. John Jardine, of Deering Street, Nottingham, have brought out a new type of self-oiling bearing, the principle of which is shown in the accompanying figure. As will be seen, it is a modification of the ring-lubricated bearing, the ring being replaced by a patent splasher B sprung upon the shaft A, which

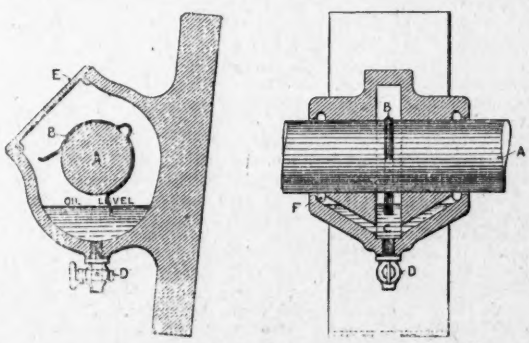


Fig. 4.—Self-Oiling Bearing.

picks up the oil and carries it to the upper side of the shaft. The waste oil returns through the channels F to the reservoir C. The oil-hole cover E is closed to keep out dirt, and the tap D allows the old oil to be run out. The makers state that they have had bearings of this type running for six months without any attention whatever and without any trouble, but they recommend oiling once in three months. Plummer blocks fitted with the oil-lifter are made in a variety of patterns and sizes.

Woodhouse Steel Casing.

The Woodhouse Steel Casing Co., of Kingsway, W.C., have received a report from the Electrical Standardising, Testing and Training Institution, showing that under a test, to discover its

electrical continuity, of five lengths of the casing and capping, 22 ft. 10 in. long in all, the resistance of either the capping or casing was under ·1 ohm. A further test, made after the casing and capping had been roughly used and bent, showed no appreciably different result. This test appears to confirm the company's claim that an electrical bond is made merely by assembling the parts.

BUSINESS NOTES.

Acheson Graphite Products.—The following communication will, we hope, finally settle the vexed question of the agency for these lubricants :—

"We have noticed in recent publications of your paper inquiries as to the firm through whom the above products are being sold ; it may therefore interest you to know that the agent for Oildag, Aquadag and Gredag is Mr. A. W. Farnsworth, of Derby, for whom we are acting as sub-agents in our district, while the agent for the International Acheson Graphite Co. is this firm, for whom, in turn, Mr. Farnsworth is acting as sub-agent.

"We trust that this will clear up any doubt which may be in the minds of your readers.—Yours faithfully,

"For 'Cromil' Engineering Co., Ltd.,
"S. H. Marshall.

"Milburn House, Newcastle-on-Tyne."

Book Notices.—*Sell's Directory of Registered Telegraphic Addresses.* 1912. Twenty-seventh annual edition. London : Henry Sell. Price 25s.—This very serviceable directory of telephone numbers and telegraphic addresses throughout the United Kingdom has been compiled with the assistance of information given by authority of the Postmaster-General, and its rapid growth in bulk until it has now reached some 2,300 pages, can only serve to indicate the increased value of the contents to business firms in these days when telegraphic and telephonic messages are the commonest of all servants of the business man. All information respecting telegraphic addresses received from the Post Office up to January 1st this year is included in the new volume. Its old-established and well-known features are as follows :—Alphabetical list of 85,000 important firms (the "Upper Ten Thousand" of the commercial world) ; index to telegraphic addresses ; classified trades lists ; and Colonial and foreign cable addresses. Every name in the volume is numbered in the margin to enable code users to cable names and addresses cheaply. The book shows a great increase in the number of telegraphic addresses registered during the year. The telephone numbers are given as well as the telegraphic addresses of registrants throughout the whole of the United Kingdom, and this should be found of convenience to those using the trunk telephone lines. There is a classified trades list containing upwards of 3,000 separate trade headings, and the names and addresses of the chief firms of the United Kingdom in every branch of business are grouped under these headings. Of course, there is a great deal of other information in the volume that is of interest to traders, such as the Post Office Telegraph Regulations, telegraph charges to all parts of the world, a list of Consuls in foreign countries, and so on.

The Russian Year-Book, 1912. By Dr. Howard P. Kennard. London : Eyre & Spottiswoode, Ltd. Price 10s. 6d. net.—This is the second edition of a work which contains such a vast amount of information regarding the resources and activity of the Russian Empire, that it must be of great value to many people. It should be of service to the many firms and individuals in this country who either already have trade and other similar relationships with, or financial interests in, that vast Empire, or are desirous to take advantage of the development spirit of the present day and join in the meeting of its enormous requirements. The opening chapters discuss matters of administration, commercial law (laws affecting trade), the rights of foreigners, population, education, postal service, and later there are sections relating to natural resources, mining and minerals, ways and communications, ports and shipping, and exports and imports. More than 80 pages are occupied with trade reports, and among these we find a brief but interesting report on "Electricity in Russia," and an equally brief one on "Machinery." There are hints to importers of Russian produce ; full notes regarding Customs regulations and tariff arrangements ; particulars regarding municipal progress ; also a very long chapter—the longest of all—relating to finance. Other features that call for mention here are tables and diagrams relating to trade, and a useful section imparting information for the use of travellers to Russia. There is an alphabetical index at the end. We can only spare space to give this general indication of the contents of this volume of over 800 pages, but we think it will suffice to recommend it to those of our readers who know that we ought to be trying to do more to develop British electrical and engineering trade connections with Russia, and who knowing, propose to take action.

"The Engineer's Year Book for 1912." By H. R. Kempe. London : Crosby Lockwood & Son. Price 10s. 6d.

"Motors and Motoring." By Henry J. Spooner. 1912. London : T. C. & E. C. Jack. Price 2s. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 1. January, 1912. New York : The Society.

"*Bulletin* of the Imperial Institute." Vol. IX, No. 4. 1911. London : Eyre & Spottiswoode, Ltd. Price 1s.

"Atti della Associazione Elettrotecnica Italiana." December, 1911. With index to Vol. XV. Milan : Stucchi, Ceretti e C.

"*Bulletin* of the Bureau of Standards." Vol. VII, No. 4. December 15th, 1911. Washington : Government Printing Office.

"Statistica degli Impianti Elettrici Attivati od Ampliati in Italia nel decennio 1899-1908." 1911. Rome : G. Berteno e C.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Speciales." December, 1911. Liége : Lahaye & Co. Price 0·75 fr.

"Kitchen Boiler Explosions." 1896. Manchester : The Manchester Steam Users' Association.

"Status of Trade Unions : Legal Recognition. The Trend of Labour Negotiations." By Fred. N. Henderson. London : Geo. Outram and Co., Ltd.

"Patents and Marks in all Republics of Latin America, 1912." From Leclerc & Co., Rio de Janeiro.

"Notes on the Fiscal Controversy." By E. G. Brunker. London : Free Trade Union. 6d.

"The Everyday Uses of Portland Cement." 1912. London : The Association of Portland Cement Manufacturers (1900), Ltd. Price 2s. 6d. net.

"Four-Place Tables of Logarithms and Trigonometric Functions." By E. V. Huntington. 1912. London : E. & F. N. Spon, Ltd. Price 3s. net.

We have received from Mr. H. D. Boret, of 9, Billiter Square, E.C., a handbook of some 80 pages relating to the sailings of the German-Australian Steamship Co., of Hamburg, for South Africa, Australia and New Zealand. Freight terms, tariffs, goods classification and other particulars are included.

Messrs. Constable & Co. will commence the publication in April next of a new periodical, to be entitled "Bedrock," "a quarterly review of scientific thought," price 2s. 6d.

A special number of "The Motor Boat and Marine Oil and Gas Engine," recently published, deals exhaustively with the latest developments in the building of high-power Diesel engines.

Staff Dinner.—The annual staff dinner of Crompton and Co., Ltd., Chelmsford, was held on Saturday evening in the club room, Writtle Road, Chelmsford. Mr. A. J. Hodgson, joint general manager, presided, and was supported by his colleague, Mr. E. Reeves, and the shop managers (Messrs. J. C. Macfarlane and Claude Crompton). Mr. W. J. F. Freeland proposed "The Firm," and alluded to the many changes in the staff which had occurred during the past 12 months. The chairman, in responding, said that owing to increased competition, the firm was passing through difficult and trying times. Trade had, however, improved of late, and he was glad to say that the outlook was now a little more hopeful. It was satisfactory that Chelmsford was free from labour troubles. He feared that members of Parliament, of whatever party, did little to foster the industries of the country ; there was too much vote-catching legislation. As regards the National Insurance Act, while all were probably in favour of the principle of national insurance, he thought the incidence of the proposed tax was unfair. In many instances it would have to be paid out of capital, and it was a direct tax upon the employment of labour. In the case of their own company, which was not making any profit, there would be an additional burden of from £800 to £1,000 per annum, which would have to be paid out of capital so long as there was not sufficient profit to cover it. The tax, he thought, should fall upon the income of the community as a whole.

Patent Notices.—An order has been made dated February 1st restoring Patent No. 4,557 of 1903, granted to Frank Michael Lewis for "Improvements in or connected with electric arc lamps." Application has been made by Mr. John Gordon, receiver for the debenture-holders of Middleton and Barker, Ltd., for the restoration of Patent No. 20,975 of 1903, for "Improved apparatus for heating water and circulating the heated water," granted to A. H. Barker.

Electricity for Scarborough Cliff Lift.—The directors of the Scarborough South Cliff Tramway Co. state in their annual report that they feel the time has arrived when a practical reconstruction of the tramway will have to be seriously considered, the cost of running by the present method being too great. "Experience shows," adds the report, "that working by electricity enables a much larger profit to be obtained. It will be necessary to prepare plans and obtain estimates. The work of reconstruction ought to start immediately after the cars cease running in November next."

Post Office Regulations and Sticky Backs.—Some weeks ago it was announced in the daily papers that the Post Office authorities deprecated the use of adhesive stamps on envelopes which were of similar size to the ordinary postage stamp, or which might tend to confusion in cancelling the postage stamps. It was stated that such letters might be delayed in the post. The practice of using adhesive labels on correspondence has been adopted by several of the metal-lamp concerns. Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, who early adopted this method of advertising, inform us that they have communicated with the G.P.O. authorities on this subject, submitting the various types of adhesive labels used by them with a view of ascertaining whether such labels would infringe the postal regulations in any way, and have received a reply stating that the labels submitted are not of such a character as would render postal packets to which they were affixed liable to be stopped. Hence all types of adhesive labels now issued to contractors by the Siemens Lamp Department may be used with safety by members of the trade on their outgoing mail, although care should be taken not to affix them in such a manner as to interfere with the addressing of the postal packets.

Foreign Contracts and Labour Clauses.—At the Blackburn T.C. meeting on February 1st, Councillor Hartley referred to a contract for the supply of steel tram rails which had been given to an American firm, and asked if the chairman of the Tramways Committee had made arrangements for someone to go over to the States to see whether this firm were paying the standard rate of wages as required by the Corporation regulations. Whatever conditions were imposed on English firms ought to apply equally well to foreign firms, he added.

Electrical Manufacturing in Japan.—H.M. Vice-Consul at Osaka (Mr. E. H. Holmes) reports that a Japanese joint stock company has recently been formed at that place, under the name of the Osaka Denki Seizo Kabushiki Kaisha (Osaka Electrical Machinery Manufacturing Co., Ltd.), for the manufacture of dynamos and other electrical machinery. The authorised capital is 1,000,000 yen (about £102,000), of which it is proposed to call up one-fourth at once. As a result of inquiries made by Mr. Holmes, it would appear that the direction of orders for plant for the new works is already settled. H.M. Vice-Consul states that the demand for such goods of every description is a constantly increasing one, but he points out that considerable progress has been made of late years in the manufacture of electrical machinery in Japan, and that Japanese manufacturers will have the advantage of considerable tariff protection.—*Board of Trade Journal.*

India.—An American Consul, reporting on Indian trade, makes the following remarks: "An active and industrious commercial agent, who has been all over India and studied the needs of the people and the business methods, said that he regarded India as the best field for American foreign trade in the Near or Far East. He returned to the United States for the purpose of getting together a line of samples with a view to returning to India and making it a permanent field of commercial operation. He stated emphatically that the only way to work India as a commercial field was to visit every store and every bazaar, exhibiting samples of superior goods and prices that would compete with English, German and French prices for the same class of goods. This young man's conclusion was no different from the conclusions reached by many other commercial men. It is safe to say that 95 per cent. of the trade in American commodities in India that have been introduced and sold here during the last six years have been the result of personal representation. Circulars and catalogues rarely get original business. After goods have been introduced and have gained a foothold, advertising literature is necessary to hold and enlarge trade."

Catalogues and Lists.—Messrs. Bayliss, Jones and Bayliss, Ltd., Wolverhampton.—Catalogue No. 11B (88 pages) containing illustrations and tabulated prices of bolts and nuts, and a variety of telegraph ironwork black and galvanised, including spindles, cupholders, stay swivels, swan-neck bolts, straining eye-bolts, &c.

Messrs. Wallach Bros., Ltd., Royal London House, Finsbury Square, London, E.C.—Small booklet of 48 pages, entitled "The Care of Belting." Belt troubles and how to avoid them, directions for making double belts endless on the pulleys, directions for lacing belts, also for covering iron pulleys with leather, are all discussed, and particulars follow of the firm's "Spartan" and "Neptune" brands of leather belting. The former is specially prepared to withstand the effects of steam, oil, acid fumes, &c., and is adapted for hard service; the latter is a special waterproof belt to withstand severe work and all effects of moisture or water. Prices are given.

The London Electric Firm, George Street, Croydon.—This is a very full catalogue of the firm's "One-working part" arc and metal-filament lamp lowering gear, self-sustaining winches and other manufactures. These include numerous details which should interest all who have to do with street and other open space lighting, and a host of photographic illustrations appears showing the application of the devices to different kinds of service in a variety of positions. Particular attention is directed to the pages devoted to lowering gear applied in connection with metal-filament lamps and clusters of lamps used for street illumination. A large sheet of illustrations of the manufactures, and street views, accompanies the catalogue.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Publication No. 185 (16 pages), containing brief descriptions, with illustrations and prices, of their mining telephones, magneto and battery ringing respectively, miner's pocket telephone, mining indicator, mining telephone switchboard, electric blasting machines, electric motor syrens, trembling, motor-driven and other bells, ringing and signalling keys, and batteries.

The Franco-British Electrical Co., Ltd., 50, Oxford Street, London, W.C.—Two new leaflets relating to their electric signs, one of which is described in our "New Devices" section to-day.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—New list, No. D3 (16 pages), containing excellent illustrations, with notes of prices of a number of luminous radiators with attractive designs in art metal, black and polished iron and copper, antique brass, copper and silver, satin gilt, oxidised silver and oxidised copper.

Messrs. Alfred H. Gibbings & Cia, 564, Cangallo 564, Buenos Ayres.—Eight-page catalogue in Spanish, containing illustrated particulars of combined engines and dynamos, electric pumps, switchboards, measuring instruments, &c.

Messrs. Galsworthy, Ltd., 15 and 16, Newman Street, Oxford Street, London, W.—New catalogue of 160 pages (art paper through out) containing excellently-executed illustrations of a fine collection of their electric light fittings. All of the fittings are illustrated to scale, and the spread and length are given, a reference being also made to the page where the bracket or electrolier, as the case may be, can be found to match a given fitting. This is, of course, a time-saving element. Beginning with wall brackets and sconces, counterweight pendants and shade lights, and proceeding with electroliers, crystal pendants, bowl and ceiling fittings, billiard and small fancy pendants, there later follow lanterns, newel standards, watertight fittings, floor and table standards. Some pages toward the end are occupied with switchplates, lamp radiators, and "Gilco" patent screw clamp, and sundries. The catalogue has a neat binding. Messrs. Galsworthy will be pleased to send a copy of the book to anyone in the trade who may not have received one.

Messrs. Switchgear & Cowans (1911), Ltd., Victoria Works, Springfield Lane, Salford.—A number of current leaflets have been issued, brought together in a folder, giving illustrated information relating to their standard manufactures. These include switchboards, H.T. enclosed panels for consumers' premises, regulating transformers; spring break, isolating, house service, Admiralty enclosed, limit, field breaking and other switches; rheostats, circuit-breakers, wall type motor panels; oil circuit breakers; motor starters; Star-Delta switches; relays, switch fuses, magnetic blow-out fuses, the Statter time-lag, and so on.

Mr. H. C. Slingsby, Old Street House, London, E.C.—New revised catalogue, No. 135 (498 pages) containing illustrations and prices of a very large variety of trucks, handcarts, &c., suitable for use in all classes of business.

The Aluminium Industry.—According to a Berlin newspaper, the negotiations for the establishment of a fresh international understanding in the aluminium manufacturing industry, which have never been entirely abandoned, have now led to the conclusion of an arrangement between the French works and the Neuhausen Aluminium Industry Co. This implies that a step has been taken in connection with the revival of the international syndicate, although it remains to be seen whether the combination will actually be constituted. On the one hand, it seems, the newspaper declares, that the English industry is not ripe for inclusion, whilst, on the other, an understanding is for the time being not possible with the American industry, the principal representative of which is also suffering from the campaign against trusts. In any case, prices in the market have recently hardened, and further progress is expected as the French works and the Neuhausen Co. are said to have already withdrawn from the market.

The formation was recently mentioned of the Société Aluminium Francais for the working of a process for the simultaneous recovery of an ammonia fertiliser as a by-product in the production of alumin-kryolit for the manufacture of aluminium. The working rights have been obtained from the Société Générale des Nitrures, and are said to permit of a substantial reduction in the cost of production. It is understood that the Société Aluminium Francais has water-powers ranging from 40,000 H.P. to 50,000 H.P. at its disposal, and as its output of alumin-kryolit is to be shared with the French aluminium companies, it would appear as if the former had been formed by the latter expressly for the purpose.

Bankruptcy Proceedings.—Oswald Carr, electrical engineer, Oak Works, Headingley, and 31, Estcourt Terrace, Headingley.—At the Leeds Bankruptcy Court last week this examination was closed. The statement of affairs showed liabilities £375, and a deficiency of £62.

Henry James Dale, electrician, 15, New Oxford Street, W.C., and 166, Pentonville Road, N.—Release of trustee (official receiver) December 21st, 1911.

For Sale.—The Coventy City Council has for disposal one 600-KW. McLaren-Schuckert generating set. The Dundee T.C. has for sale five tons of old cable copper. Messrs. Wheatley Kirk, Price & Co., will, on Friday, February 23rd, sell by auction, the plant and effects of the Cowper-Coles Engineering Co., Ltd. (in liquidation). For further particulars see our advertisement pages to-day.

Trade Announcements.—Premises at 4, Townwall Street, Dover, have been opened by Mr. E. Arthur Pinto, electrical engineer.

The A.E.G. Electric Co. has opened showrooms at 2, Station Road West, Canterbury, with Mr. E. F. Turner as representative.

Having, during a recent business tour in U.S.A., ascertained that there was a considerable demand for many of his new types of electrical standard and testing instruments, Mr. Robert W. Paul has opened a branch laboratory and showroom at 1, East 42nd Street, New York, which will be in charge of Mr. C. J. Brown, formerly at the firm's London works.

Dissolutions and Liquidations.—Bohm Lens Lamp Co., Ltd.—Creditors must send particulars of debts, &c., by March 18th to the liquidator, Mr. E. S. Neave, 15, Great St. Helens, E.C.

Wakelin Bros., Ltd., 7, Tottenham Street, Tottenham Court Road, London.—Meeting of creditors and contributories will be held on February 16th at Carey Street, W.C.

Battery Contracts.—Messrs Pritchetts & Gold, Ltd., of Westminster, have recently supplied one of their well-known storage batteries to H.R.H. Prince Christian, K.G., P.C., G.C.V.O., at Cumberland House, Windsor. Another recent order was placed with this firm by H.R.H. the Duchess of Albany for replacing the existing battery at Claremont, Esher, with a new battery of 1,000 ampere-hours capacity. The same firm are also supplying a battery to Sir Alexander M. Rendel, K.C.I.E., for his country house

New Steel Works at Swansea.—The *Times* reports that Messrs. Baldwin & Co. are going to put down immediately an extensive steel-making plant on the Burrows, Swansea, where they have already large tinplate works. "The new steel works will have an output of 5,000 tons weekly, and the expenditure involved is between £100,000 and £150,000. It is Messrs. Baldwin's intention to follow on with the erection of blast furnaces."

LIGHTING and POWER NOTES.

Abingdon.—A petition is being signed at Abingdon in favour of facilities being given to a company to provide an E.L. installation for the town. The T.C., it will be remembered, has decided to apply for a prov. order.

Accrington.—Mr. Percy Allen, of the Castner-Kellner Alkali Co., has accepted the engagement as consulting engineer in connection with the installation of a gas generating plant for the electricity works extensions, at a fee of 50 guineas, plus expenses.

Australia.—The North Sydney Council is moving to secure electric lighting powers, the idea being to prepare a joint scheme for all the North Shore municipalities.

The purchase of the gas company's undertaking (which includes electricity supply) has been practically concluded by the Perth (W.A.) Council, the arbitration award fixing the price at £419,312. A loan of £525,000 is to be raised for purchasing the property.

It is interesting to note that the suburbs of North Perth, Subiaco and Leederville have their own electric lighting plants, also that Claremont, situated between Perth and Fremantle, has its own plant.

Bantry.—Last year terms were arranged between a Mr. Nugent and the local Commissioners, by which that gentleman supplied an electric street lighting installation in the town, which has now been in satisfactory operation for a week or so.

Barrow-in-Furness.—At the T.C. meeting on Monday it was decided that the town clerk, treasurer, surveyor, gas and water manager, and electrical engineer be instructed to confer on the question of formulating a scheme to prevent the frequent breaking up of carriage-ways and footpaths for the purpose of laying new mains, &c.

Beckenham.—At its last meeting, the U.D.C. decided to ask the B. of T. to consider the revocation of the powers of the electricity company entitled to supply the West Wickham district, but which has not exercised its right. If the Board agrees to that course the Council will take steps to obtain powers to supply the district. The Council found it impossible recently to supply in West Wickham on reasonable terms, and that is the basis of the action.

Biddulph.—With reference to the proposed electrical scheme, the U.D.C. has decided not to pay more than 5 per cent. on the cost of the works (£5,000), except the cost of the ordnance survey plans, to the experts engaged, Messrs. Crews & Handford. The latter asked to be allowed certain travelling and other expenses.

Bognor.—The U.D.C. has decided to offer no opposition to the Bognor electricity prov. order, but to lodge a petition against the Bognor Gas Co.'s Electricity Bill, on the following grounds:—That it is not desirable that a monopoly for supplying two illuminants should be in the hands of one company; that there is no clause in the Bill authorising the Council to purchase the undertaking; that the maximum price to be charged for current is excessive; and that the time within which mains should be laid in the compulsory area was extended to three years instead of two years, as in the case of the prov. order.

Bolton.—At a meeting of the Electricity Committee held on February 1st, the proceedings of the special Sub-Committee appointed by the Electricity Committee with reference to the scheme of the electrical engineer for the proposed new station at Back-oth-Bank were approved, which thereby recommends the adoption of the scheme.

Bridlington.—The T.C. has received from the L.G.B. sanction to loans of £1,900 for mains and £800 for services.

Bury.—The Corporation has lodged an objection with the Board of Trade against the granting of a provisional order to the Lancashire Electric Power Co. for supplying electricity in Radcliffe.

Canada.—From present indications, the scheme of the Long Sault Development Co. to dam the St. Lawrence is again in the air. J. Wesley Allison, Morrisburg, whose efforts in opposition to the scheme aided in its defeat before Congress last year, left for Washington at the end of last week to confer with the interests connected with the scheme as to the basis upon which work will be allowed to go on so far as Canada is concerned. It is not, however considered likely that the Dominion Government will withdraw a single one of its objections already advanced against the proposal. That the opposition is not confined to Canada is evident from the fact that it is understood that Governor Dix, of New York, will suggest that the Bill of the Long Sault Development Co., in so far as it gives power to the promoters throughout New York State to develop power on the St. Lawrence, be repealed. Governor Dix will further suggest that if it is found necessary to develop power on the St. Lawrence, that the State vote an appropriation for that purpose, and that power be delivered to the people direct from the State, and that no lease be granted to private companies or corporations.

The Calgary, Albt., Council has approved of a total of $200,000 for electric lighting extensions for 1912, and $168,000 for extensions to the city power plant during the coming year.

Cheltenham.—The T.C. has decided to give private consumers the option of a flat rate of 5d. per unit, with a discount of 5 per cent.

By a three years' agreement, the Light Railway Co. is to pay 1·3552d. per unit for a minimum of 600,000 units, and ¾d. per unit beyond.

Continental Notes.—Austria.—Great activity prevails in the districts lying around Salzburg in the erection of local generating stations. One firm only—F. Papouschek—in the past year have carried out, or have in hand, as many as eight such schemes, viz., at Wald, Hollersbach, Reitdorf, Lungötz, Russbach, St. Michael Markt, Thalgau and Materndorf, the last-named being a reconstruction and re-equipment of an existing station. The installations of electric plant in various industries have also been numerous, and, altogether, the past year is considered to have been a very prosperous one.

A high-pressure transmission service, many miles in length, is being set up between Kolin and Newbydzow, in Bohemia, to serve Konigstadl and all the villages within the Konigstadl circuit. Temporarily, current is being supplied by a private firm at Chlumetz, but eventually a power station to be built at Kolin will serve the network.—*Der Elektrotechniker.*

It is announced that the municipal authorities of Vienna have just purchased a colliery at Zellingsdorf, Lower Austria. It is proposed to establish an electricity generating station in conjunction with the pits and to transmit the current generated to Vienna for electric lighting and power purposes.

Germany.—The municipal electricity undertaking at Altona is being taken over by a new company, which has just been formed, with a capital of £175,000, and the title the Electricitätswerk Unterelbe Gesellschaft.

An international rural generating station, to serve clients on both sides of the Dutch and German frontiers in the Bourtanger Moor district, and stretching from Meppen to Wegener on the left bank of the Ems River, is about to be established. The districts to be served are mainly agricultural, and include the circuits of Aschendorf, Hümmling, Lingen and Meppen. The Dutch districts are warmly interested in the scheme, the negotiations for the realisation of which are approaching a conclusion.—*Zeitschr. fur Elektro. und Maschinenbau.*

Belgium.—La Société d'Electricité du Borinage is now supplying current to 20 small towns and villages, the number of clients connected to the supply mains being 2,200.

La Société d'Electricité de l'Est de la Belgique has secured the concession for the supply of electrical energy for lighting and power purposes in the town of Lambermont.

Russia.—The Compagnie d'Electricité de Bialystock reports a large increase in the demand for current for power purposes. There are a large number of textile mills in the town of Bialystock, the proprietors of many of which have decided, owing to the high cost of coal in the district, to adopt electrical driving of the spinning and weaving machinery.

The work of establishing the new central station in Odessa of the Société d'Electricité d'Odessa is being pushed ahead as rapidly as possible, as the demand for current for lighting and power purposes is in excess of what can be supplied from the existing plant, which is furnishing current to 85,000 lamps and 82 electric motors.

A loan is being arranged for a Russian municipality, the proceeds to be devoted to various public works, including electrification of tramways and purchase of rolling stock. Further particulars may be obtained on application to the B. of T.

A new system of mains, for the supply of electrical energy for lighting and power purposes, is being laid down in the town of Simferopol by the Société des Tramways et Eclairage de Simferopol.

Spain.—The municipal authorities of Moncofar (province of Castellon), have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

France.—It is proposed to erect a large hydro-electric station utilising the River Doubs. A barrage is to be constructed above Soubey, and thence water will be taken through a 38-km. tunnel, penetrating the Clos du Doubs, to the village of Ocourt. Soubey being 485 m. above sea level and Ocourt only 435 m., there is a gross difference of level of 50 m. A velocity of flow of 1·70 m. per second through the tunnel, which is to be of 5·25 sq. m. cross-section, will yield a discharge of about 6 cb. m. per second. The power station is to be erected at Ocourt, and will contain three hydro-electric generators of 1,250 kw. each. The maximum total output of the station will fall from 3,600 kw. to 1,000 kw. in periods of drought, when the flow of the Doubs is only 19 cb. m. per second. The barrage will cause a considerable rise in the level of the Doubs up-stream to Clairbie—about 3 km. away and near the French frontier—and the scheme when completed will be the most important in the Jura district.

La Société Generale d'Electricité, Paris-Province, is the name of a new company which has lately been formed in Paris, with a capital of £10,000.

Dartford.—The U.D.C. has applied to the L.G.B. for a loan of £10,000 for the following purposes:—"Uniflow" engine and balancer, £3,300; switchboard, £600; superheaters and piping, £800; feed pump, £160; buildings, £2,290; boiler, £1,600; contingencies, £250; three years' mains and services, £1,000.

Darwen.—The subject of electricity as a motive power was raised at the meeting of the Corporation on February 5th, when Councillor Butterworth referred to the erection of new mills in the town, and asked what progress was being made with regard to the owners using electricity for the running of the machinery. Councillor Thornley replied that the matter had received careful attention, but he did not think it was advisable to enter into details at that stage. Everything was being done to produce current as cheaply as possible, with a view to encouraging cotton mill owners, but not at a loss to the Corporation.

Dublin.—At a recent meeting of the City Council, Alderman M'Walter moved that the 10 per cent. which was added to the price of electricity, to make up for losses sometime ago, should now be taken off. An amendment was, however, carried that the resolution be sent to the Electricity Committee for consideration and report, on the ground that there was no demand by the consumers for any reduction.

Eccles.—The Electricity Committee has received a communication from the L.G.B., in which it was stated that for reasons therein mentioned, the Board does not consider that it would be justified in complying with the application for sanction to borrow £666 for the purpose of lighting certain streets in the vicinity of Cromwell Road, by electricity.

Falkirk.—The outcome of the plebiscite of the ratepayers, taken on the question as to whether the Linlithgow and Falkirk District Electric Lighting order, now being promoted by Mr. George Balfour, London, should be opposed by the promotion of another burgh extension order, has resulted in the advice of Mr. Balfour Browne, K.C., London, being adopted. It will be recalled that he advised the extension of the burgh boundaries as the most effective means of opposing the order. The vote resulted in a majority for this of 1,363; 77 per cent. of the electorate voted.

Halifax.—Members of the T.C. on Monday made a tour of inspection, and at the electricity works a new 1,500-KW. turbo-alternator, which has been installed to meet the increased demand for electrical energy for motive-power purposes, was started up.

Headington.—The B. of G. is to discuss the appointment of a Committee to consider the lighting by electricity or otherwise, of the workhouse, where at present oil lamps are used.

Lancaster.—A conference is to be held between members of the Electricity and Lighting Committees in reference to the question of cost and other matters connected with street lighting by electricity.

Liverpool.—In pursuance of a resolution passed by the Electricity Committee in December last, the consulting electrical engineer (Mr. A. Bromley Holmes) and the city treasurer, have reported to the Committee on the position of the electrical undertaking with a view to the reduction of charges to consumers. After reviewing the financial position of the undertaking, the report points out that last year in Liverpool there were sold 37,765,203 units, with an income of £265,475, these figures including 15,149,005 units for lighting and power (£165,966), and 22,616,198 units for tramways (£99,509). The average price received was 1·687d. per unit. As regards the ·349d. per unit for works cost, it was reported that "very little reduction on the cost of production can be anticipated from increased output, as the last published works cost of the two undertakings which alone have a larger output than Liverpool—namely, Manchester, with an output of 83,308,848 units, and Glasgow, with an output of 40,823,090, somewhat exceed the Liverpool works cost, where the output is 37,765,203 units." So long as the Committee was able to continue the policy of replacing old by modern plant of greater capacity out of reserve and renewals fund, the cost per unit of the interest and sinking fund would decrease with the increased output. The flat rate scale for lighting runs from 3½d. per unit to 2½d., and for power from 2d. to 1d. according to the quantity taken. The maximum demand scale for lighting is a fixed quarterly charge of £2 per KW. on maximum demand (as registered by a demand indicator), and 1½d. per unit; and for power £1 per KW. on rated capacity of plant installed and ½d. per unit. The rateable value scale of charges is a fixed quarterly charge of 4½ per cent. on the rateable value of the premises and 1d. per unit. Details are then given of certain suggested concessions, which may be summarised thus:—(1) The charge for the supply of private houses on the rateable value system to be reduced to 2½ per cent. per quarter and 1d. per unit; (2) for shop lighting and other trade uses, a reduction from 4½ per cent. to 3½ per cent. per quarter; (3) for consumers requiring a "long-hour" service, the present power rate of £8 per KW. per quarter, and ·5d. per unit to be reduced to £6 per KW., and ·4d. per unit.

The Committee at the meeting on February 2nd approved the concessions recommended in the special report.

It is reported that the net balance on the Corporation electric supply for 1911 amounts to £48,141. The Electricity Committee has allocated £3,141 to the reserve fund, £20,000 to the renewal fund, and £25,000 to the relief of the general rate.

London.—Bermondsey.—A loan of £2,782 is to be taken up from the L.C.C. for electric lighting purposes, made up as follows: £2,000 for mains, £32 for plant, (switchboard), and £250 for house services.

Stepney.—The Electricity Supply Committee has adopted the recommendation of the electrical engineer and manager as to offering lower terms for electric lighting purposes in factories, workshops and warehouses, the proposed rate to be, as from the dates of the meter readings upon which the monthly accounts for March, 1912, are based, 4d. per unit, for 300 hours' use per annum of the maximum demand, and ½d. per unit for all further consumption per annum, upon the following conditions, viz.: (*a*) That all artificial lighting used on the premises, as defined above, be derived from the Council's electricity supply mains; (*b*) that all power (exclusive of heating) used on the premises, as defined above, be derived from the Council's electricity supply mains; (*c*) that the mean "maximum demand" for power purposes (as defined and applied in Clause 4 (4) of the Council's general conditions) be not less than thirty electrical horse-power; and (*d*) that the consumer's total accounts (calculated on the rates upon which they are rendered) for any half-year ending on the dates of the meter readings upon which the monthly accounts for June and December are based, amount to at least £60, or that the consumer guarantees this amount as a minimum payment for each such period. In calculating the total amount of a consumer's half-yearly bill for the purpose of arriving at the minimum above mentioned, the accounts for lighting, power and other purposes, on the same or different premises, to be added together; provided that where the accounts of different premises are so added together, the average half-yearly account per service shall not be less than £15. This matter came under consideration owing to certain large consumers in the district who carried on business in factories and closed about 7 p.m., contending that under the Council's existing tariff the average charge per unit was too high to warrant them extending their lighting installation or even continuing the use of their existing installation. The Committee points out that although the recommendation would at the moment result in a decrease in revenue, there was little or no doubt that this also would, in view of the anticipated demand likely to ensue therefrom, be of a temporary character only.

Loughborough.—The T.C. has consented to a proposed bulk supply of electricity to the Brush Co. Negotiations between the Corporation and the company have been in progress since August last, when the company made a proposal that the Corporation should supply them with the whole of the electricity required for their works for light and power. The company estimated their requirements at not less than 1,000,000 units per annum, for which they were prepared to pay "something under ½d. per unit." Subsequently the company offered to give a guarantee for a consumption of 1,250,000 units per annum on a 10 years' agreement at ½d. per unit. The Electricity Committee recommended the Corporation to give a supply on these terms, with an increase of ·01d. per unit for every 6d. per ton increase in the price of coal, on the company agreeing to supply the turbo-generator and other plant on a hire-purchase system as suggested by them. The report was approved, together with a recommendation that application be made to the L.G.B. for sanction to a loan for the necessary extensions to buildings, plant, &c., estimated at £14,000.

Maidstone.—The B. of T. has sent the T.C. an order enabling it to supply current to Springfield Mill, which is outside the borough.

The T.C. has decided to hold a series of demonstrations of electrical cooking during the month; it has also applied to the L.G.B. for a loan of £550 for a motor-generator.

New Zealand.—It is proposed by the Napier B.C. to raise a loan of £15,000 for the construction of electric power and lighting works and electric tramways which have been approved on a poll of the ratepayers of the borough.—*Board of Trade Journal.*

North Berwick.—Further particulars of the proposal to introduce a scheme of electric lighting into North Berwick were brought before a meeting of property owners and other residents at the Royal Hotel. Mention was made of the fact that an agreement had been entered into between Messrs. Crompton & Co. and the Corporation, and that it was intended to float a company to carry out the scheme. Mr. J. C. Ivens, as representing the company, gave a general outline of the proposed installation, together with details of the cost. For purposes of comparison a statement was submitted showing the cost and results of similar undertakings in 10 towns of varying population, and the estimate afforded was favourable to North Berwick.

Reigate.—The T.C. has sanctioned the conversion of 30 gas lamps to electric lighting during the year.

Rochdale.—The Corporation has applied to the L.G.B. for sanction to borrow £8,700 for extensions of buildings and plant at the Dane Street electricity generating station, and an inquiry has been fixed for the 13th inst.

Salisbury Plain.—It is stated that the Army estimates for the financial year of 1912-13 will contain a large provision for electric lighting of barracks in various parts—particularly where new barracks have been erected in recent years. A sum of £50,000, it is said, will be spent at Salisbury Plain and the adjacent camps. A considerable time has elapsed since the Army authorities found out that one of the causes of discontent amongst the soldiers in those remote camps was the ill-lighting of their quarters and the vicinity.

Shipley.—A decision by the Electricity Committee of the U.D.C. that the engineer should prepare plans and estimates for the submission of a scheme to the L.G.B. providing for alteration to buildings at the electricity works, extension of condensing, boiler and turbine plant, and extension of mains, was not adopted by the Council at its meeting last week, it being agreed that the matter should be more fully considered. The financial statement of the Electricity Department for the nine months ended December last showed an income of £8,199, compared with £6,974 in the corresponding period of the previous year, and an expenditure of £5,158, compared with £3,580.

Southampton.—The electrical engineer has been instructed to obtain quotations for a standard motor for the locomotive used in the haulage of coal trucks to the electricity works. Application is to be made to the Local Government Board for sanction to borrow £5,000 for general mains. In reply to a letter suggesting the desirability of wiring houses free, or at a very nominal cost, the town clerk has been instructed by the Electricity Committee to reply to the effect that the suggestion could not be entertained, but that the Council would be prepared to put in installations on the assisted wiring system.

Southgate.—The North Metropolitan Electric Power Supply Co. is to be asked to submit for the Council's consideration terms for the lighting of the Green Lanes main road, and to arrange with the surveyor for the erection at certain points of sample lamps.

Stoke-on-Trent.—The Education Committee has appointed a Sub-Committee to discuss with a Committee of the T.C. the advisability of installing the electric light in schools in the Hanley and Tunstall areas.

Sunderland.—The Electricity and Lighting Committee of the T.C., in its estimate of revenue and expenditure for the year, anticipates a credit balance on the year's working of £5,006, compared with £1,194 for the previous year. The total expenditure is estimated at £55,269, and embraces the following chief items: £12,488, cost of generating current; £5,747 distribution expenses; £4,393, management and general expenses; £11,806, interest on loans; and £16,630, sinking fund contribution. There is an increase in the cost of generating current of £1,063, chiefly due to the increased expenditure on coal, the total for which is £8,204, as compared with £7,375, but the total output, it should be noted, estimated at 11,721,956 units, exceeds that of the previous year, by 1½ million units. The revenue is estimated at £60,275, against £55,253 for the previous year. The revenue from current for power purposes is estimated at £29,668, an increase on the previous year of £4,713. With a view to encouraging the use of current for heating and cooking, the Council has under consideration a proposal to reduce the price per unit to those consumers who are under the domestic rate, where they pay a fixed charge, according to rental. The reduction suggested is from ¾d. to ½d. per unit.

The Electricity Committee has decided to recommend the installation of a 5,000-KW. turbine with new cooling tower, cables, travelling crane, two new boilers, &c., at a total cost of £22,207. In December, 1911, there was a maximum demand of 5,740 KW. on the Hylton Road plant. Further power customers bring the demand up to 6,165 KW.

Taunton.—Mr. T. C. Ekin, the L.G.B. inspector, has held an inquiry relative to the application of the T.C. for sanction to borrow £2,500 for the purposes of the electricity undertaking. Mr. G. Spiller, chairman of the Electricity Committee of the Corporation, said he was convinced that the loan would tend to the more successful working of the undertaking. The application was not opposed.

Wakefield.—The Corporation has given notice that an application has been made to the B. of T. for consent to the placing of certain electric lines above ground, along various routes in the city, for the transmission of electrical energy at a pressure of 230 volts for the purposes of supply under the Wakefield Corporation Electric Lighting Order, 1894.

Wednesbury.—In consequence of the increasing demand or electric current in the borough, the Lighting Committee has recommended the purchase of a 230-KW. engine and dynamo at a cost of £3,500. A special arc lighting main is to be laid for the convenience of shopkeepers in the market place at a cost of £200. This, as well as the above recommendation, was confirmed at a meeting of the T.C. on Monday, when it was stated that 75 new customers had been obtained during the year, and that the electricity manufactured has gone up from 400 to 528 KW. It was also stated that £40,000 was now vested in the electricity undertaking of the town.

Whitworth.—The Rochdale Gas and Electricity Committee recommends, in reply to a request, that the Whitworth Council be informed that the Committee is willing to give the supply of electricity in bulk at the Rochdale borough boundary in Whitworth Road on the same terms as the supply to Littleboro', and with the addition of the Whitworth Council guaranteeing a minimum annual payment.

TRAMWAY and RAILWAY NOTES.

Australia.—The Perth (W.A.) Council is stated to be going to purchase 32 motor-omnibuses at a cost of £40,000, to run in competition with the Perth electric tramways, owing to the failure to adjust terms of purchase as between the Council and company.

A movement is on foot by Fitzroy, Northcote, and Preston, suburbs of Melbourne (V.) to secure tramway communication with the latter city.

Blackpool.—A proposal to establish an interesting postal innovation came before the Council on January 31st, the Postmaster suggesting, as the result of a request from several tradesmen, that letter boxes should be fixed on cars, as at Bradford, so that persons missing the last connection in their own neighbourhood, may thus be able to catch the general post. The suggestion is that anyone may post a letter in this way at an "All cars stop" station, but that if a car is specially stopped at a "By request" station, a fee of 1d. shall be paid. The proposal was referred to the Tramway Committee. It is probable the system will be adopted.

For the financial year to date, the net revenue increase from the tramways shows the satisfactory amount of £7,828; the greatest advance being on the Promenade, £3,211; Marton, £1,009; and circular route, £2,782. The receipts per car-mile were 1s. 5¾d., against 1s. 3½d. last year. There had been an increase in the number of passengers carried of 1,342,595.

Continental Notes.—AUSTRIA.—It is stated that the French group competing for the financing of the projected underground and city railway in Vienna recently held out the prospect of the presentation of a binding offer within a very short time, so that a decision as to its acceptance could be arrived at up to May. This fact has induced the Vienna banks and electrical companies to meet and decide that the latter should prepare a general scheme up to May, when the banks will submit their financial proposals based upon the project.

Plans are being prepared in respect of a projected light electric railway between Oderburg and Deutschlenten.

The Austrian State Railways Administration has granted to the Silesian Provincial authorities at Troppau, permission to draw up plans for the construction of a narrow-gauge electric railway from Oderberg to Deutschleuten, passing by way of Skrzeczon.

ITALY.—The *Gazzetta Ufficiale* publishes decrees granting to the "Società Anonima Ferrovie e Tramvie Padane" a concession for the construction and working of a railway from Fano to Fermignano; authorising the Turin Communal authorities to construct and work (*a*) an extension of the Barriera San Paula—Barriera Casale electric tramway as far as the Trombetta Bridge, and (*b*) a section designed to connect the Borgo San Paulo—Barriera Grande line with the Pozzo Strada—Barriera Casale line.

Hull.—As the result of a poll on the proposed Parliamentary Bill, the Bill was rejected. Out of 57,000 electors, only 7,000 odd voted, and the vote cost £500. The principal items in the Bill were the extension of the tramways to Stoneferry and the erection of a new North Bridge, the estimated cost of the whole of the improvements being £250,000.

Leicester.—It is stated that the electric tramways system is about to be extended by running a line through King Richard's Road, thus linking up the Fosse Road section with West Bridges. The capital expenditure involved will, it is understood, come out of revenue, except so much as is allocated from the tramways reserve fund.

Lowestoft.—The T.C., at a special meeting on Monday, decided to apply for a loan of £10,000 for tramway purposes, £1,080 being for track foundation work; £2,337 for rails, joints and anchors; £5,901 for paving Lorne Park Road in Jarrah wood; and £682 for contingencies.

Lytham.—Owing, it is stated, to lack of local financial support, the electric light scheme projected here by the Lytham Electric Light and Power Co. will not be proceeded with.

North-Eastern Railway.—The half-yearly report of the directors shows that, for the half-year ended December last, the electric trains ran 598,988 miles, or slightly more than 2,000,000 car-miles; electric goods trains account for an additional 2,700 train-miles. The cost of electric train working is given as £16,726, made up of £12,842 for electrical energy and £3,884 wages of trainmen.

Nuneaton.—With reference to the proposed electric tramway scheme, the Highways Committee of the T.C. has reported that the institution of a tramway service would be of great benefit, and that railless traction would be admirably suited to local requirements. A route of 3¾ miles has been selected, and the estimated total capital cost is £9,000.

Oldham.—The Tramways Committee is considering the advisability of running railless cars from Moorside to Grains Bar.

Ramsbottom.—A poll of the ratepayers of the urban district of Ramsbottom (Lancs.) was taken at the beginning of last week on the proposal of the local D.C. to institute a system of railless cars. The number of votors in the urban area is 4,029, bnt only about 1,400 took the trouble to vote. For the cars there voted 991; against, 407.

Oldbury and Blackheath.—At a meeting of the U.D.C. last week, considerable dissatisfaction was expressed respecting the position of the question of tramways to Blackheath. Councillor Green introduced the matter, and suggested it was high time the Council moved again, as the question had been under consideration for six months. The deputy clerk said they were waiting for the Tramway Co. Councillor Green said he did not think the Tramway Co. wanted to take the matter up. He added that there ought to be tramways running to Blackheath to-day. Ultimately the clerk was instructed to write again to the company.

Reading.—The T.C. has applied to the B. of T. for a loan of £3,000, to meet the cost of removing the tramway standards from the carriage-ways to the side pavements, and the provision of new cables, fittings, wires, &c.

Rotherham.—The T.C. has decided to purchase three railless cars for the Maltby section at a cost of £725 each.

Scarborough.—The South Cliff Tramway Co. is stated to be considering the advisability of operating its inclined tramway by electric instead of hydraulic power.

Stretford.—The District Council has under consideration the laying of a tramway track along Seymour Grove, Chorlton.

Sunderland.—The Tramways Committee of the T.C. has just issued its estimate of income and expenditure for the year ending March 31st, 1912. The income is expected to be £68,581 (including £67,300 traffic receipts), as against £59,920 total income for 1910-11. Traffic expenses are put down at £18,511, compared with £17,409 for the previous year. General expenses £5,827, compared with £5,330; repairs and maintenance £4,400, as against £3,770; power, &c., £10,700, against £10,677; £6,015 is placed to the reserve and renewal fund. It is estimated there will be a balance in favour of the borough fund of £5,000, which, with the allocation to the reserve, represents a net profit of £11,015, compared with £3,941 for the previous year.

Todmorden.—The T.C. on January 30th considered a suggestion for the adoption of railless traction. A sub-committee reported that before visiting Bradford and Leeds it had been very sceptical as to the suitability of the railless system for Todmorden, but it was now fully satisfied it was in every way suitable. The cost of running was about 6d. or 6½d. per car-mile, compared with 13d. per car-mile for the motor-omnibuses now in use. The ease, comfort, silence of running and absence of jerks were great advantages. The report was adopted, and the Council decided to discuss the question further in committee.

TELEGRAPH and TELEPHONE NOTES.

"All-Red Route."—It is reported that a definite contract between the P.M.G. and the Marconi Co. for the erection of wireless stations, in connection with an Imperial wireless system, is about to be concluded.

Anglo-Dutch Telephony.—Last week London was placed in telephonic communication with Amsterdam, for experimental purposes, and speech was transmitted very distinctly.

P.O. Telephone Factory.—The recommendation of the Departmental Committee that the telephone repairs factory at Nottingham, taken over from the National Telephone Co., should be removed to Birmingham, where the Post Office stores are situated, has aroused the Nottingham people to a vigorous protest. The change would mean a heavy loss to the city.

South Africa.—Two new telegraph lines are to be run from Capetown to Johannesburg, and a third from Capetown to Durban, while others are contemplated.—*British and South African Export Gazette.*

Telephone Assessments.—At a meeting of representatives of Scottish rating authorities, held at Glasgow on January 30th, a resolution was passed reaffirming the principle that until the whole basis of local rating was revised, the Government telephone undertaking should be subject to contributions in lieu of rates based upon the actual valuation thereof, and it was agreed that a deputation should wait upon the Postmaster-General to discuss the subject.

The Telephone Service.—As the result of numerous complaints regarding the telephone service, a Telephone Users' Protection Association has been formed, with Mr. C. S. Goldman, M.P., as chairman. Mr. A. E. Bale, of Dunedin House, Basinghall Avenue, E.C., points out that such an Association was formed in 1907, and still exists, in a state of suspended animation.

Uruguay.—The Government has issued a regulation requiring all vessels that carry passengers to or from Uruguay to be provided with wireless telegraph apparatus by May 1st, 1912.

Wires Cut by Meteorite.—According to a note in the *Daily Mail* of February 2nd, the telegraphic apparatus in connection with the signal station at Finisterre was destroyed on January 25th by the fall of a meteorite.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

Melbourne.—March 5th. Telephone material (Sch. 612); also 120 miles rubber-insulated cotton-covered tinned copper wire (Sch. 594). March 12th.—Instruments (Sch. 639); for Deputy P.M.G., Melbourne.

February 26th.—Five miles of cable, for the P.M.G.'s Department. See "Official Notices" January 26th.

Austria.—February 15th. The Austrian Post and Telegraph authorities in Vienna are inviting tenders for the supply of 4,845,000 metres of insulated cable.

Beckenham.—February 12th. Arc lamp carbons (flame), electrical house cut-outs, and service boxes, for a year, for the U.D.C. F. Stevens, Clerk.

Belfast.—February 12th. One automatic coal-weighing machine, and overhead electrical equipment material, for the Corporation. See "Official Notices" January 26th.

February 19th.—Stores for a year, for the City Electricity Department. See "Official Notices" February 2nd.

Belgium.—February 28th. The Belgian State Railway authorities at La Bourse, Brussels, are inviting tenders for the supply of a 25-ton electric travelling-crane for the railway workshops at Cuesmes.

Birkenhead.—February 13th. Continuous-current meters, house service fuse boxes, low-tension main cable, I.R. lead-covered and armoured service cable, for the Corporation. See "Official Notices" February 2nd.

Blackburn.—February 12th. Stores for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" January 26th.

Bolton.—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" to-day.

Bournemouth.—February 20th. Coal for the Corporation Tramways Department, for three or 12 months, from April 1st. I. Bulfin, general manager, Lansdowne Crescent (returnable deposit of £1 1s.).

Bristol.—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" January 26th.

February 20th.—Arc lamp carbons, joint and fuse boxes, A.C. meters and D.C. mercury-type ampere-hour meters, for a year, for the Corporation. See "Official Notices" to-day.

Cardiff.—February 17th. The Union is inviting tenders for one 30 ft. by 8 ft. Galloway, Lancashire or Yorkshire type boiler and superheater. Specifications and forms of tender from Mr. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

Coventry.—February 22nd. Water-cooling plant of a capacity of 250,000 gallons per hour, for the City Electricity Department. See "Official Notices" to-day.

Croydon.—February 19th. General stores and goods, for tramways department, for a year, for the T.C. Tramways Manager, Thornton Heath.

Dublin.—February 14th. Arc lamp carbons, for the Corporation. See "Official Notices" to-day.

Epsom.—February 13th. 200-kw. Diesel generating set for the U.D.C. See "Official Notices" January 26th.

Halifax.—The Electricity Committee has decided to invite tenders for the supply of a 3,000-kw. turbo-alternator for the electricity works.

H.M. Office of Works.—February 21st. Fuse and switchboards, for a year. See "Official Notices" to-day.

Hungary.—Pecs.—February 28th. Erection of a new power station. Particulars, Municipality.

Mor.—Erection of a power station. Particulars, Elektricitäts-Direction.

Ilford.—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" to-day.

Ipswich.—February 21st. One water-tube boiler, for the Corporation Electricity Department. Specifications and forms of tender, £1 1s. (returnable), from Mr. Frank Ayton, engineer and manager, Constantine Road, Ipswich.

Italy.—February 29th. H.M. Consul at Cagliari (Mr. R. H. Pernis) reports that tenders are invited by the municipal authorities at that place for the establishment of an electric generating station, the construction and working of electric tramways over a distance of 3,280 metres (about two miles), and the illumination of the principal squares and streets of the city by electricity. For further particulars, see this column last week.

Kirkcaldy.—February 29th. 1,000-KW. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" to-day.

Leeds.—February 14th and 21st. (*a*) 1,000 A.C. meters and (*b*) 40,000 tons of steam coal and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 19th.

March 9th.—6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" to-day.

London.—BERMONDSEY.—February 19th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 26th.

BATTERSEA.—February 20th. Materials and stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

FULHAM.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 2nd.

HAMMERSMITH.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

POPLAR.—February 16th. Extensions to E.H.T. and D.C. switchboards, for the B.C. See "Official Notices" February 2nd.

ST. PANCRAS.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" to-day.

Manchester.—February 20th. (*a*) Tramcar type ampere-hour meters, and (*b*) general stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

February 14th.—For supply, delivery and erection at Stuart Street electricity works, of (*a*) high-pressure steam and feed pipes and supports connected to two marine-type boilers; (*b*) work required in connection with the installation of a battery of 16 patent sand filter units in roof tank. Specifications and forms of tender from F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

Pontypridd.—February 21st. Stores and materials for a year, for the U.D.C. Electric Light and Tramways Department. See "Official Notices" to-day.

Portsmouth.—February 20th. Stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

Portugal.—March 2nd. The "Conselho de Administração do Porto de Lisboa," Lisbon, invites tenders for the supply of 10 electric cranes. For further particulars, see this column for January 19th.

Rhodesia.—A complete electrical plant is to be installed at the Shamva property, Rhodesia, and orders for both surface and underground machinery and accessories will shortly be on offer.—*The British and South African Export Gazette.*

Rugby.—February 10th. Willans-Diesel oil engines and Victoria turbo-pumps, with variable speed, for the U.D.C. D. G. Macdonald, water engineer.

Sheffield.—February 12th. Electrical fittings for two years for the Health Committee of the T.C. Cleansing Superintendent (returnable deposit of 10s.).

Siam.—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

Tunbridge Wells.—February 10th. High and low-tension switchgear, for the Corporation. See "Official Notices" January 12th.

Wallasey.—February 12th. One 500-KW. alternator and Diesel engine combined, for the Corporation. See "Official Notices" January 26th.

Walthamstow.—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

Warlingham.—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

York.—Electric shunting locomotive for the Corporation. See "Official Notices" January 19th.

CLOSED.

Accrington.—Messrs. Mather & Platt, Ltd., have just been instructed to proceed with a large contract for the Accrington and Church Outfall Sewage Board, which comprises 24 of their pipe-arm type of revolving distributors, each 62 ft. in diameter, complete with all appurtenances, as well as a sewage pump, screening mechanism, motors to drive the machines, and also the lighting work.

Belgium.—Six concerns submitted tenders last week to the municipal authorities of Ghent for the supply of a steam turbine-alternator generating set at the central electric lighting station, the lowest offer being that of a local firm of engineers, Messrs. Vanderkerkhor.

Birmingham.—The Tramways Committee received the following tenders for steel tramway rails and fishplates:—

Bolling & Lowe (representing Phœnix Steel Works, Ruhrort, Germany) .. .. (recommended)	£11,461
Lorain Steel Co. (whose rails are manufactured in America) ..	12,494
Walter Scott, Ltd. .. .. (accepted)	13,155

"It will be observed," says the report, "that the German tender is £1,694 lower than the English tender, and that the American tender is lower by £661. Your Committee, after giving the matter most careful consideration, particularly with regard to the actual experience in Birmingham of the wear of both German and English rails, feel bound to recommend the Council to authorise the acceptance of the tender of Messrs. Bolling & Lowe (as representing the German firm above named) at the sum of £11,461."

The above tenders were under discussion at the Council meeting on Tuesday, and by 43 votes to 29 the Committee's recommendation was rejected; the tender of Messrs. Walter Scott, Ltd., of Leeds, at £1,700 above the German tender, being accepted. According to a newspaper report, one of the speakers who opposed the recommendation said that German firms could afford to sell more cheaply than British firms owing to the bounty on exports and to the cheap carriage by waterway.

Bolton.—The Tramways Committee has accepted the following tenders:—

Robinson & Sons, Sagar & Co., Cowley & Co.—Woodworking machinery for new repair shop.
Hadfield's Steel Foundry Co., E. Allen & Co.—Special trackwork.
J. W. Witter.—Heating apparatus.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Herbert Morris, Ltd., for the electrification of a gantry crane; and that of Messrs. Holt & Willetts for two lifts for the cold stores.

Burnley.—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., to supply 800 yards of cable required in connection with the supply of electricity to the Burnley Barracks and the Burnley Ironworks.

The Board of Guardians has accepted the tender of the Tudor Battery Co. for the supply and erection at the workhouse of a lighting battery and the removal of the existing battery, for £458. There is also a maintenance contract of £41 10s. per year for 10 or 15 years.

Dartford.—The U.D.C. has entered into an agreement with the Electrical Power Storage Co., Ltd., for the maintenance of the storage battery for a further five years, at £75 per annum, with the option of a further renewal for five years.

Douglas (I. of M.).—The T.C. has accepted the tender of Mr. Hanson Perry, of Douglas, for the electric light installation at the Villa Marina. The installation will consist of a 12-H.P. oil engine, of the Diesel type, with a 9-KW. generator.

Louth.—The County Council received the following tenders for installing electrical fittings in Dundalk Court House:—

J. M. Gowdy	£77
Dundalk Motor Works	180
J. O. Meldon	89
E. Gallagher	91
Gaskin Bros. .. .. (accepted)	90

Mersey.—The Diesel Engine Co., Ltd., of London, have received an order from the Worthington Pump Co., Ltd., of London, for five Diesel engines, of 1,000 B.H.P. each, for the Mersey Docks and Harbour Board. These engines are for use in connection with the new Gladstone Dock now being built, and will be direct coupled to five 54-in. Worthington centrifugal pumps, running at a speed of 180 revs. per min., and having an aggregate capacity of 47,000 cb. ft. per min. The engines, which will be built by Messrs. Carels Bros., of Ghent, will consist of four cylinders each, of their latest two-stroke type, fitted with outside crosshead, and very similar in design to the Carels-Diesel marine engines, which are now being so widely adopted both in this country and on the Continent. This will be by far the largest installation of Diesel engines in this country. The whole of the above work will be carried out to the specifications of Mr. Anthony G. Lyster, engineer-in-chief to the Mersey Docks and Harbour Board.

Northampton.—The T.C. has accepted the tender of Messrs. Davey, Paxman & Co., Ltd., at £1,190, for a boiler, superheater and all accessories, for the tramways power station.

Perth.—Messrs. Chamberlain & Hookham, Ltd., have received an order for car meters.

London.—POPLAR.—The B.C. has accepted the following tenders in connection with the electricity undertaking :—Erection and completion of superstructure of extension of generating station, Thomas & Edge, £4,668 ; steelwork in connection therewith, Fairweather & Ranger, £2,485 ; supply and erection of ash elevator, New Conveyor Co., £250. This was the second lowest tender of five, and was recommended by the engineer on the grounds that the gearing could be more conveniently enclosed than any other form of driving gear ; the worm gear was enclosed in a cast-iron dust-tight box, was fitted with ball bearings, and was constantly immersed in oil.

L.C.C.—The following were the tenders submitted for (1) 3,550 tons of track rails and fastenings, and (2) 1,050 tons of slot rails and 400 tons of conductor tees :—

(1) TRACK RAILS AND FASTENINGS.

	Rails of carbon steel.	Rails of Sandberg high-silicon steel.
	£	£
Bolling & Lowe (manufactured at Phœnix Works, Ruhrort, Germany)	21,849	22,564
Scholey & Co., Ltd. (manufactured at Phœnix Works, Ruhrort, Germany) ..	21,849	22,564
P. & W. MacLellan, Ltd. (manufactured at Phœnix Works, Ruhrort, Germany) ..	22,190	22,915
P. & W. MacLellan, Ltd. (manufactured by the North-Eastern Steel Co., Ltd., Middlesbrough) (alternative tender)	27,260	29,035
Walter Scott, Ltd. .. (recommended)	24,867	26,592
Bolckow, Vaughan & Co., Ltd.	26,166	27,941
Barrow Hæmatite Steel Co., Ltd.	28,052	—
Cammell Laird & Co., Ltd.	34,849	36,624

The chief engineer's estimates comparable were £24,612 for rails of carbon steel, and £26,769 for rails of high-silicon steel.

(2) SLOT RAILS AND CONDUCTOR TEES.

Frodingham Iron and Steel Co., Ltd. .. .. (recommended)	£12,607
Walter Scott, Ltd...	12,849
P. & W. MacLellan, Ltd. (manufactured by North-Eastern Steel Co., Ltd.)	13,405
Steel, Peech & Tozer, Ltd.	13,925
Bolling & Lowe, Ltd. (manufactured at Phœnix Works, Ruhrort, Germany)	13,992

The chief engineer's estimate comparable was £12,345.

The Committee reported as follows :—"The tenders have been carefully examined. As regards the track rails and fastenings, the three lowest tenders provide for the manufacture of the rails in Germany, at the Phœnix Works, Ruhrort. We would point out that the difficulties of inspection during manufacture are greatly increased when the rails are made abroad, and the same control cannot be exercised over the work. Considerable extra cost has also to be incurred when the work extends over a long period. We are advised that to have the rails delivered direct to the work in progress, in quantities as required, is of considerable advantage, and saves the expense of storage and second handling. Moreover, when rails are obtained from abroad there is always risk of delay to work and consequent loss and inconvenience to the public, owing to rails not being available as the street work is opened up. We understand that the best results have been obtained from rails made of high-silicon steel, and we therefore think that the rails should be of this manufacture. In all the circumstances, we think that the lowest offer submitted by a British firm for rails of high-silicon steel, that of Walter Scott, Ltd., amounting to £26,592, should be accepted. In addition, a sum of 5s. a ton will have to be paid to Mr. Sandberg for royalty and supervision charges. The expenditure under this head will amount to about £863. As regards the slot rails and conductor tees, we think that the lowest tender submitted, that of the Frodingham Iron and Steel Co., Ltd., amounting to £12,607, should be accepted."

For the supply of 50 car sets of truss plates, the tenders received were as follows :—

Hurst, Nelson & Co., Ltd. .. .. (accepted)	£487
United Electric Car Co., Ltd.	650
Brush Electrical Engineering Co., Ltd.	700
East Ferry Road Engineering Works Co., Ltd.	760
S. H. Heywood & Co., Ltd.	1,150

STEPNEY.—The B.C. Electricity Committee received the following tenders for one E.H.T. converting plant at the Limehouse and Whitechapel stations :—

General Electric Co., Ltd.	£4,787
Do. do. (alternative tender, not to specification)	4,410
B. Peebles & Co., Ltd.	4,942
Brush Electrical Engineering Co., Ltd.	4,995
British Westinghouse Electric and Mfg. Co., Ltd. ..	5,290
Spagnoletti, Ltd.	5,606
Dick, Kerr & Co., Ltd.	6,282
Electric Construction Co., Ltd.	6,388
Siemens Bros. Dynamo Works, Ltd...	4,909
Do. do. (alternative tender, not to specification)	4,569

The alternative tender of the General Electric Co. does not comply with the specification, and both tenders of Messrs. Siemens Bros. Dynamo Works, Ltd., do not include all the plant specified. The formal tender of the General Electric Co. offers plant too long for the space available, and the price originally quoted does not include all the auxiliaries necessary, for which they require an extra of £80, which has been added to their tender.

Messrs. B. Peebles & Co.'s machine would, with the exception of one or two minor details, be a duplicate of the existing 1,500-KW. machine at Osborn Street, and spare parts, &c., could therefore be dispensed with, thus reducing the tender of Messrs. B. Peebles and Co., Ltd., to £4,847.

Mr. Tapper, the engineer, in his report, says that he has compared the relative guaranteed efficiencies of the machines included in the two lowest tenders. The guaranteed efficiency of the Peebles machine is from 3 per cent. to 7½ per cent. higher than that of the General Electric machine, which will result in an annual saving of approximately £60, which, capitalised at, say, 7 per cent., is equivalent to over £800, thus making the Peebles machine actually the cheaper of the two. He therefore has no hesitation in recommending the acceptance of the tender of Messrs. B. Peebles & Co., Ltd., £4,942, less £95 for spare parts, &c., not required.

Post Office.—The General Electric Co., Ltd., have again secured the Post Office contract for the supply of metal-filament lamps for the forthcoming six months, all lamps to be English made. This contract has been secured after exhaustive Post Office tests on both English and foreign lamps, and it includes every type for which the firm have tendered from 25 V., 5 C.P.

Salford.—For the supply and erection complete of 20 outside covers for bogie cars, the T.C. has accepted the tender of Messrs. Hurst, Nelson & Co., Ltd., at £151 per cover.

Southampton.—The T.C. has received the following tenders for the supply of one motor-alternator :—

Lancashire Dynamo & Motor Co., Ltd.	£1,085
Electric Construction Co., Ltd. .. .. .. (accepted)	1,266
Dick, Kerr & Co., Ltd.	1,376

The Electricity Committee has accepted the offer of Messrs. Dick, Kerr & Co., Ltd., at £8,090, to supply a duplicate of the steam generator with a Cole, Marchant engine and surface condensing plant installed by them two years ago. The contracts with Ferranti, Ltd., and the British Thomson-Houston Co. for the supply of 600 and 400 meters respectively, are to be extended for a further period of 12 months each, delivery to be made as required.

Staffs.—The Education Committee has accepted the tender of the General Electric Co., Ltd., for the renewal of electric lamps in the Council schools.

Swindon.—The tender of the Diesel Engine Co., Ltd., for a Diesel generating plant for the electricity works, at £6,376, has been accepted by the T.C.

Winchester.—The T.C. has accepted the tender of Messrs. Leroy & Co. for re-covering all steam apparatus at the electricity works with standard plastic non-conducting composition, at £90 ; and that of Messrs. W. & T. Avery, Ltd., for a weigh-bridge, at £62.

FORTHCOMING EVENTS.

Institution of Civil Engineers (Students' Meeting).—Friday, February 9th. At 8 p.m. Lecture on "Steam Turbines," by Capt. H. Riall Sankey.

Northampton Institute Engineering Society.—Friday, February 9th. Paper on "Radio-Telegraphic Detectors," by Mr. W. Gilbert.
Friday, February 16th.—Paper on "Water Turbines," by Mr. D. Cue.

Physical Society.—Friday, February 9th. At 8 p.m. At the Imperial College of Science, South Kensington. Annual general meeting. Presidential address by Prof. A. Schuster.

Institution of Electrical Engineers (Scottish Local Section).—Saturday, February 10th. At the Grosvenor, Glasgow. Annual smoking concert.
Tuesday, February 13th.—Meeting at Edinburgh.

Association of Engineers-in-Charge.—Saturday, February 10th. At St. Bride's Institute, E.C. Social. Dance.
Wednesday, February 14th—At 8 p.m. At St. Bride's Institute, E.C. Paper on "Steam Turbine Machinery," by Mr. A. A. A. Wynne.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, February 12th. At 6 p.m. At the I.E.E. Paper on "Economies of Telephone Transmission," by Mr. A. W. Martin.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, February 12th. Meeting at 7.30 p.m.

Institution of Mechanical Engineers (Graduates' Association).—Monday, February 12th. At 8 p.m. Lecture on "Recent Researches at the National Physical Laboratory," by Dr. T. E. Stanton.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, February 13th. At 7.30 p.m. At the University, Manchester. Paper on "Specifications," by Mr. F. S. Sells.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, February 14th. At 7.30 p.m. At the University, Birmingham. Paper on "Automatic Reversible Battery Boosters," by Mr. R. Rankin.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, February 14th. At 7 p.m. At the University, Leeds. Paper on "Residence Tariffs," by Mr. A. H. Seabrook.

Institution of Mechanical Engineers.—Friday, February 16th. At 8 p.m. Annual general meeting.

Junior Institution of Engineers.—Saturday, February 17th. At 6.30 for 7 p.m. At the Hotel Cecil, London, W.C. Annual dinner.

Finsbury Technical College O.S.A. Dance.—The fifth annual dance run by the Old Students of this College was held on Saturday last, February 3rd, at Caxton Hall, Westminster. Those present claim that a more enjoyable evening was never spent. The President, Mr. R. J. Wallis-Jones, and his wife received the guests, and the arrangements were under Mr. P. V. McMahon's able care. Mr. W. M. Mordey and many other old Finsbury men turned up, as also did Mr. P. F. Rowell and his wife. With Pritchard's Band, all went exceedingly well, and everyone spent a very jolly time.

Police Hand Lamps.—The Watching Committee of the Aberdeen Town Council has resolved to provide 20 electric hand lamps for the night police, by way of experiment.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders are issued :—

Monday, February 12th.—"A" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Tuesday, February 13th.—"B" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Thursday, February 15th.—"C" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Friday, February 16th.—"D" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Saturday, February 17th.—Mobilisation week-end run at Dover. The party for this run will parade at Charing Cross Station, S.E. and C. Railway, at 2.10 p.m. for the 2.22 p.m. train, sharp. Dress: Service dress, putties, greatcoats, belts and haversacks; no arms will be taken.

(Signed) J. H. S. Phillips, Major,
For Officer commanding L.E.E.

NOTES.

The Electrical Engineers' Ball.—This annual function, which is to take place at the Hotel Cecil on Friday, the 16th inst., promises to be a great success. We are asked to state that all who have not as yet secured tickets and made arrangements for attending should do so promptly, through some member of the Committee, or the Hon. Secretaries, Messrs. A. M. Sillar and H. Alabaster

The Thomas Transmission and the Dewar Trophy.—We have been informed by the Thomas Transmission, Ltd., of 14, Leonard Place, Kensington, W., that the Royal Automobile Club Committee has awarded them the Dewar Trophy for the most meritorious performance in connection with the certified trials held under the regulations and observation of the club during 1911. This award was in respect of the trials carried out with a lorry (see Elec. Rev., May 5th and June 23rd, 1911) and touring car, fitted with the Thomas electro-mechanical transmission, which was fully described in the issue mentioned above. Our readers will join with us in congratulating the Thomas Transmission, Ltd., on this official recognition of the excellent qualities of electrical speed control, the more so because automobile manufacturers in this country appear to have a rooted objection to any form of speed control which does not include an inflexible and unmechanical arrangement of gearing. Possibly this recognition on the part of the R.A.C. will open the eyes of the manufacturers to possible and much-needed improvements in their cars.

Glasgow Smoke Abatement Exhibition.—We have received a prospectus of this Corporation exhibition, which has been arranged for September 20th to October 12th next. The exhibition will be under the auspices of the Corporation, the British Electrical and Allied Manufacturers' Association, the Coal Smoke Abatement Society and the Smoke Abatement League of Great Britain. The exhibits will comprise appliances for lighting, heating, cooking, power, &c. A copy of this pamphlet, containing full information regarding the classification of exhibits, demonstrations, competitions and other matters, can be obtained from the general manager, Mr. James M. Freer, 38, Bath Street, Glasgow.

Walking Club.—We are informed that the Clapham Walking Club was duly inaugurated at last Saturday's meeting held at the Alexandra Hotel, Clapham Common, and the secretarial work is now in the hands of Mr. E. H. Roofe, 2, The Oval, Kennington. The annual subscription is 5s, with 1s. extra first year for nomination fee. The general meeting for the purpose of forming the Hackney Walking Club will be held on Saturday, February 17th, at 6 p.m., at the Farleigh Hotel, Amhurst Road, Stoke Newington, and all interested are asked to communicate at once with Mr. S. C. Haynes, hon. sec. (*pro tem.*), 20, Penda Road, Clapton Park, N.E. The inquiries from those engaged in the electrical trades in London and the provinces have been so satisfactory that it is now proposed to form an Electrical Trades Walking Club, with London headquarters central to the majority of the members. All the clubs will join a proposed National Walking Union, which in turn will affiliate to the National Athletic Union. All particulars can be obtained from Mr. A. R. Edwards, 303, Amhurst Road, London, N. We understand that arrangements are going ahead for the London to Southend Walking Race to be held on Good Friday, and offers of assistance will be welcomed.

A New Tramway Track.—The Bradford city engineer, Mr. W. H. S. Dawson, has produced a tramway track foundation which it is believed will prove six times stronger than the best at present in existence in Bradford. A specimen section has been laid at Bowling. The adoption of the new foundation will involve an increase of £100 per mile on the cost, but it is claimed that advantages will accrue more than compensating for the extra cost, in the increased length of life of the track and the smoother running of cars.

The Telephone Service.—Since our leaderette on this subject went to press, we have seen in the *Times* a letter from Lord Devonport, chairman of the Port of London Authority, asking the P.M.G. when he hopes to restore the telephone service to its normal state of efficiency and usefulness—for at present, "so far as the Port Authority is concerned, it has ceased to be a reliable aid to business." Coming from such a source, this complaint must be taken seriously; it is probably due to the impending change-over of the Avenue exchange, which is situated in a district presenting exceptional difficulties. Where no such change has taken place or is contemplated, there should be no deterioration in the service.

Electric Baking.—The Skiles Bakery, of Milwaukee, Wis., which has had a 10-kw. 80-loaf electric oven in service several months, is now preparing to install a 30-kw. 360-loaf oven. The local experience with the smaller apparatus has convinced Mr. Skiles that, compared with the ordinary coal-heated affair, the electric oven has the advantages of saving coal and ash storage space, the expense, labour, dirt and annoyance of handling coal and ashes, unpleasant heat in the workrooms, &c. The electric ovens, which are built on the multi-storey plan, occupy only one-fifth the space of the old ovens, and can be started up much more quickly, attaining a baking temperature within 45 minutes after the heat is applied.

The new 360-loaf oven, which is being built by the Westinghouse Co., will have a maximum demand of 30 kw. and a running demand of 20 kw. It will be in use 20 hours a day, as in the case of the present unit, assuring a consumption of about 20,000 kw.-hours per month. Under these conditions the bakeshops will earn a rate of 2¾ cents to 3 cents per kw.-hour, the energy cost for baking amounting to about ½ cent per loaf. Wheat bread requires 30 minutes to bake, so that the large oven will produce 720 loaves per hour, or 14,400 per day.

One of the greatest attractions of electric baking in the case of the Skiles Bakery has been the advertising afforded, and the increased business which resulted following the announcement of the use of the electric oven. This advantage is felt to have offset fully the slightly higher cost of operation of the electric oven. Final proof that the owner considers it a good investment is afforded by the present plan to install an additional and much larger apparatus, giving a total capacity of more than 15,000 electrically-baked loaves per day.—*Electrical World.*

A Large Electrical Project in Norway.—In the parish of Aurland, at the Sognefiord, in the neighbourhood of Bergen, there is an immense amount of water-power available, which it is now proposed to make use of for industrial purposes. There are in all five rivers, flowing through five separate valleys. Natural water reservoirs are provided by 33 lakes, of various sizes, in the mountains. All the water rights have been collected, and options thereon acquired by Director Hiorth, of Christiania. During last summer and autumn engineers were constantly busy surveying the district and making the necessary calculations and estimates for the regulation and harnessing of the water-power. The estimates are nearly complete, and are based upon two alternatives. The whole quantity of water will be conducted through Laaidalen, one of the valleys. In either case it is proposed to conduct the water through a tunnel, and the expenditure for each alternative will largely depend on the cost of the particular tunnel chosen. One of the alternatives will require a capital expenditure of £777,777, with a height of fall of 800 m. The second alternative will require an amount of £1,111,111, with a height of fall of 900 m. In the latter case the available power will amount to 150,000 h.p. There were about 70 owners of water rights, who have disposed of the same for £16,667. There is no information available as yet as to the purpose for which the power will be used, although it is almost a certainty that electrical ironworks will be erected.

Electrical Installation at the New Whitehall Club.—The new Whitehall Club, Princes Street, Westminster, recently built to the plans of Mr. H. Chatfeild Clarke, F.R.I.B.A., is fitted throughout with electric light, the installation having been designed with a view to combining the highest possible illuminating efficiency with economy both in first cost and in energy consumption. The fittings employed have been carefully chosen to suit the style and purpose of the various rooms; the metal work of the fittings is finished throughout in real bronze colour, and the same remark applies to the switch and bell-push plates, portable standards, &c. In the main entrance-hall use has been made of the well-known Holophane spherical fittings; these are of 16 in. diameter, and carry each one 100-c.p. metallic-filament lamp. Similar fittings, but of smaller size, were selected for the staircase and landings. In the dining-room large electroliers carrying six lamps each are used, with Holophane prismatic shades, giving, in conjunction with frosted lamps, a soft but adequate illuminating effect. The general lighting in the room is supplemented by a number of wall brackets designed to match the electroliers. In the smoking-room electroliers of a lighter pattern, also carrying six lamps each and Holophane satin-finished shades, are used, while in the adjoining card-room each card-table is lit by means of an ornamental three-cord counterweight pendant fitted with a moss-green silk shade. The billiard-room, situated on the third floor, is fitted with specially designed billiard-table fittings carrying six high-candle-power lamps; each lamp is placed under a moss-green silk shade lined with white cardboard, and the lighting of the tables is most successful. A telephone installation enables the members to communicate directly from any floor with

the public exchange. The wiring work was carried out by Messrs. Foote & Milne, Ltd., with C.M.A. v.r. insulated conductors enclosed in solid-drawn screwed steel conduits. The switch and fuse distribution boards are of Messrs. Spagnoletti & Co.'s manufacture. The ornamental fittings were supplied by the General Electric Co., Ltd., and Messrs. Veritys, Ltd., respectively, the special billiard-table fittings being designed by the first-named. The installation includes a number of electric fans, a sewage-pump motor, a Waygood electric passenger lift from ground to third floor, and three electric goods lifts. The consulting engineer for the electrical work was Mr. Reginald J. Wallis-Jones.

Copper.—The general impression that the consumption of copper is increasing is borne out by Messrs. H. R. Merton's statistical circular for mid-January. The visible supplies have dropped to 55,583 tons, a decrease of 1,700 tons from the end of December, and deliveries stand at 22,647 tons for the fortnight, thus promising to exceed last year's average monthly European consumption of 41,080 tons. Supplies from North America promise to be well above average; from Spain and Portugal just on average; Chile shipments promise low, and Australian are about as usual. The stocks in Rotterdam have dropped 150 tons to 5,150, and in Hamburg are estimated to have increased 200 tons to 8,300. French stocks remain steady, at 5,240 tons. Resuming the position for last year, a writer in the *Financial News* points out that in 1911 prices practically reversed the course they took in 1910; whereas in the former they rose from £53¾ to over £64; in 1910 they fell from £62 in January to £56 in December. In 1910 the frequent reports of an amalgamation may have held the market up against falling demand.

The world's consumption, estimated by Messrs. Lewis at 875,000 tons, shows an increase of 155,000 tons in four years, in spite of reduction of output on the part of a few producers. The United States contributed just under 500,000 tons, increasing in the past year by 15,020 tons, or over 3 per cent., the falling off in the yields from Lake Superior and Montana being considerably more than balanced by those of Arizona and other States, chiefly Utah, Nevada and New Mexico. Other producing countries have not done much in increased output except Queensland, which has sent 6,500 tons more metal to this country, and Mexico, which has increased its figure by about half that amount. Consumptions, as far can be estimated, run as follows:—United States, 325,431 tons; England, 97,192 tons; France, 80,837 tons; Germany, 135,487 tons. The United States consumption is thus lower than for the year 1910, and Germany's increased 48,700 tons.

Supplies, as shown by Messrs. Merton's statistical circular for January, were brisker during the month, thus preventing very heavy withdrawals from stocks. The reduction in visible supplies for the month was 1,713 tons, the figure for Europe being now 55,570 tons. Supplies to European ports, and especially to English ports, from North America were high, and to English ports from Spain and Portugal the same remark applies, though the supply to other countries from these producers was not up to average. Shipments from Chile are above average, but from Australia rather below. Demand has been strong, total deliveries reaching 48,808 tons.

Havre has increased stocks by 234 tons, while Rotterdam is lower with 4,900 tons and Hamburg 100 tons higher at 8,200. The combined visible supply (excluding Holland and Germany) for the end of December was 97,218 tons, American stocks being only 39,935 tons.

Institution of Electrical Engineers: Annual Dinner.—On Thursday last week the annual dinner and reunion of the Institution took place at the Hotel Cecil, with the President, Mr. S. Z. de Ferranti, in the chair. The attendance was rather below the average, being about 340, but was representative not only of the Institution and its Local Sections, but also of many other important societies and of Government Departments, educational institutions, local authorities, and the great professions. Amongst those present were the Lord Chief Justice, the High Commissioner for the Commonwealth of Australia, Lord Justice Fletcher Moulton, Lord Justice Buckley, Prof. Unwin (President Inst. C.E.), Sir James Crichton-Browne, Sir T. Barlow (President Royal College of Physicians), Sir N. J. Moore (Agent-General for West Australia), Sir W. Ramsay (President British Association), Sir H. Monro (Permanent Secretary to the L.G.B.), Sir A. King (Secretary G.P.O.), Sir J. W. Taverner (Agent-General for Victoria), Sir L. Gomme (Clerk to the L.C.C.), Sir P. Magnus, the Lord Mayor of Dublin, the President of the Elektrotechnischer Verein, Sir J. Larmor, Sir H. J. Donaldson, Mr. R. J. Godlee (President Royal College of Surgeons), Sir A. Keogh, Sir B. A. Whitelegge, Sir R. Hunter, Mr. Justice Parker, Sir Norman Lockyer, Sir H. Truman Wood, Mr. E. E. Ellington (President Institution of Mechanical Engineers), Mr. G. Wilkinson (President Inst. M.E.A.), Prof. H. L. Callender (President Physical Society), Dr. R. Messel (President Society of Chemical Industry), and many members of the Council.

It was understood that the toasts would be few in number, and the speeches short, an arrangement usually hoped for, but seldom realised; on this occasion, however, the programme was carried out with admirable precision, and as the President claimed at 9.45, when he announced the adjournment to the Victoria Hall, a new record was established. After the loyal toasts, the Right Hon. Lord Alverstone proposed "The Institution of Electrical Engineers," recalling some amusing incidents which he had experienced at previous gatherings of the Institution. He wished prosperity to the Institution, which, he said, he joined as a life member, in the hope that it would soon come to an end and distribute its assets, but in that he was disappointed. It had already had a distinguished career, largely because it adapted itself to modern progress, and had commanded the support of the most distinguished members of the profession, such as Sir William Siemens, Latimer Clarke, Sir Charles Bright, Dr. John Hopkinson, Prof. Ayrton, and, above all, Lord Kelvin, thrice President. He had no doubt its future would be as successful as its past. The toast was coupled with the name of the President, and was received with great enthusiasm and musical honours.

Mr. Ferranti said he appreciated the honour of occupying the chair during his second term of office as president. The members of Council bore a great responsibility, as electrical engineering was passing through new phases of development, and a different state of affairs now prevailed. Electricity was not merely a scientific matter nowadays, and the Institution must be the guardian of the interests of the electrical industry as a whole. The first thing to be done was to persuade the industry that it contained no divergent interests, and develop a feeling of union amongst all branches. They were now experiencing the good results of the policy which led them to acquire the Institution building; it enabled all the different interests to meet at headquarters, and thus showed them that they were all striving for the same end. It was most fortunate that they as the Institution of Electrical Engineers had been able to promote the development and harmony of the numerous branches meeting there. The Institution had always had the power to include as members eminent men who were not actually electrical engineers, but had not fully exercised it. They wanted to broaden the basis of the Institution and include all whose work was the development and progress of electrical enterprise, with immense benefit to the electrical industry. That question had received the consideration of the Council, and when the plan was carried out the Institution would be greatly strengthened. In this country electricity had been handicapped in many ways—for instance, by the difficulty of obtaining wayleaves, one of the greatest obstacles to progress, and one without any valid reason. The Council was considering how matters could be improved in this connection. They would have to educate the community to a better feeling. Another important question was the price of electricity, which was higher than it should be, due to the unfair way in which electrical enterprise had been treated. There was no one to look after the industry in this country, so a Committee for the protection of electrical interests was formed; that Committee was now in collaboration with them, so that the work would be pushed on with the whole weight of the Institution. His view was that it was the business of the Council to exert the whole influence of the Institution for the furtherance of the interests of the various sections which it represented. He hoped they would all work together in the cause, and all would benefit from the result.

Prof. S. P. Thompson proposed "Our Guests," of whom so many of great eminence were present. He cordially supported the policy of which the president had laid down the lines, to develop the Institution and make it of more use in the world, and said the Council wished to associate with them those who exercised influence in the larger walks of life. They must enlist the services of such eminent men as the Lords Justices who were present, the Agents-General for the Colonies, the representatives of great Government departments, and prominent officials in the public service. Sir George Reid responded, and expressed his appreciation of the reform in the matter of speeches. He referred to the great achievements of electrical science, dwelling in particular upon the fact that, thanks to electricity, the cry of those in peril on the sea could rise above the tumult of the waves and guide the rescuers to the spot.

The company then adjourned to the Victoria Hall, where the customary reunion took place. This is a most popular feature of the occasion, and a large number of members remained until a late hour, renewing old friendships and forming new acquaintanceships.

Social Events.—By invitation of Mr. J. W. Meares, Electrical Adviser to the Government of India, an "Old Cromptonian Dinner" was held at Calcutta on January 11th. The toast list was as follows:—"The Junior Partner," S. G. L. Eustace; "The Consulting Engineer," H. H. Reynolds; "Plant," E. A. Saunders; "Cable Department," C. H. R. Thorne; "Town Lighting," J. T. Mertens; "Rope Gearing," F. Powell Williams; "Rubber Goods," W. T. Jennings; "The Old Firm," G. Rackstraw; "The Projector," J. W. Meares.

The first annual Bohemian Concert of the G.E.C. Athletic Club was held on Saturday evening last at the Oval Concert Hall, County Cricket Ground, Kennington Oval, S.E. A large attendance and an excellent programme combined to make the event a great success. Mr. Leonard Byng took the chair, and during the evening the "Davis Challenge Cup" and medals were presented to the winners. The St. James' Electric Supply Club was successful in the football competition, carrying off the prize for 4 goals to 0.

On Friday evening, February 2nd, the "Siemens's Supplies Smoker," organised by the staff at 39, Upper Thames Street, E.C., took place in the Pillar Hall, at Cannon Street Hotel. The chair was taken by Mr. C. Koettgen, managing director of Siemens Bros. Dynamo Works, Ltd. Those present were edified with literature regarding the "Zed" fuses, and while entertained with an excellent programme, were also soothed by "Special Zed" smokes—all high voltage—brown colour carrying 4 amperes and white 50 amperes.

Institution and Lecture Notes. — INSTITUTION OF MUNICIPAL ENGINEERS.—At a general meeting to be held on Saturday, February 24th, a paper on "Superannuation and Security of Tenure; the National Association of Local Government Officers and its Bill" will be read by Mr. A. W. Gray. The discussion will be an open one.

The Society of Engineers.—The first ordinary meeting of the present Session was held on February 5th, at the Institution of Electrical Engineers. The retiring President, Mr. F. G. Bloyd, presented the premiums awarded for papers published in the *Journal* during 1911, and then vacated the chair in favour of Mr. John Kennedy, the President for 1912, who delivered his Inaugural Address, dealing with shipbuilding and marine engineering.

Northampton Institute Engineering Society.—On January 26th, 1912, Mr. J. O. Ruscoe read a paper on "The Silent Knight Engine." As at present built the engine has two sleeves sliding one within the other, and both within the cylinder. These sleeves, which contain the ports, are driven by eccentrics from a half-time shaft, which, in turn, is driven from the main crankshaft by a silent chain drive. These engines were subjected by the Technical Committee of the Royal Automobile Club at the request of the Daimler Co. to 132 hours' continuous bench test, 2,000 miles' running test on Brooklands track in not more than 60 hours of running time, and a 5 hours' bench test; the tests were carried out in a very satisfactory manner by the two engines selected by the judges, and it was found that no part showed any appreciable wear at the completion of the test.

On February 2nd a paper on "Steam Turbines Utilising the Impulse Principle, with special reference to the Disc and Drum Type," was read by Messrs. T. R. Houston and F. G. Parnell.

Royal Institution.—On Friday a lecture was delivered by Sir J. Mackenzie Davidson on "Vital Effects of Radium and Other Rays." He said that the Finsen arc had recently been superseded by the quartz mercury vapour lamp, but with both, the effects were confined to the surface. The skin-burns experienced by workers with X-rays were largely contributed to by the secondary rays, which were much more easily absorbed than the primary ones. He showed a comparatively large amount of radium made from pitchblende in this country.

Junior Institution of Engineers.—A party of members of this Institution, through the kind permission of Mr. G. E. Pingree, managing director, paid a visit recently to the works of the Western Electric Co. at North Woolwich, and were shown over the various departments. On February 12th the Institution is holding a combined meeting with the Architectural Association, to hear and discuss a paper by Mr. P. Waterhouse on "Bridges," and on February 17th the annual dinner is to be held.

On February 1st Mr. T. R. Smith, electrical engineer to the Leicester Corporation, delivered a lecture to the Leicester and District Workers' Educational Association on "Electricity for Light, Heat and Power."

Johannesburg Tramcar Contracts.—According to the *British and South African Export Gazette*, at the request of the Transvaal Manufacturers' Association, the Johannesburg Municipality has decided to throw open the tendering for 10 new tramcars to Colonial coach and wagon builders.

Kingston-on-Thames Diesel Engines.—In connection with our remarks in the "Lighting Notes" section last week (page 175), Mr. J. E. Edgcome, the Council's engineer, writes to point out that the British Westinghouse Co. were invited to tender for the Diesel engines, although from the note he thinks it might appear that this was not the case. The fact that their tender was considered is, however, shown on page 169, where particulars of the Westinghouse tender are set out, together with those of six other firms. Mr. Edgcome assures us that these were carefully considered by his committee, and that the report was carried by 19 votes to 6, and 5 neutral, not 19 votes to 9, and 3 neutral, as mentioned by our news correspondent.

Contract Conditions for Pretoria.—The *British and South African Export Gazette* says that the Pretoria Municipality has decided that tenderers for municipal contracts shall in future provide two sureties, that every tender shall hold good for 30 days, that any tenderer who withdraws a tender after it has been opened, or who fails to take up a contract when called upon to do so, shall be debarred from tendering for further work for two years, and that the practice of requiring a deposit with a tender is to be abolished.

Appointments Vacant.—Foreman cable jointer and overhead linesman, for the Lancaster Corporation (40s.); canvasser (£3) and draughtsman (£3), for the Sunderland Corporation Electricity Supply; traffic superintendent, for the Darlington Corporation Tramways (£130). See our advertisement pages in this issue.

Fatality.—It is reported that John Black, an electrical engineer, was killed at Hartford Colliery, Northumberland, on Monday, through coming in contact with a live wire. The fatality was the subject of a coroner's inquiry on the 6th inst., at Hartford Colliery, Northumberland. Mr. Black was an electrical engineer engaged by the British Westinghouse Co., and on the 3rd inst. he was engaged at the Scott Pit, Hartford Colliery, when he was killed.

Robert Hudspeth, an electric fitter employed by the British Westinghouse Co., stated that on the 3rd inst. he was engaged making some alterations to the switch-handles at the bottom of the shaft. Mr. Black, who was in charge of the work, descended the pit later, and came to look at the switch which had been finished. Black asked for the current to be turned off. Witness isolated the switch, and Black looked inside it and then took hold of the handle. When, a little later, witness looked at Black again, the latter was standing straight up, with his hand on the switch, staring, and he appeared to have had a shock. Witness caught hold of Black's coat-tails, and the colliery electrician threw coat over him, and they pulled him off. Black then collapsed, and died in about half-an-hour. In reply to Mr. Atkinson, H.M. Inspector of Mines, witness said that when he got to the pit he asked for the current to be cut off, but when the assistant "rapped" a message they could get no reply, and they decided it was quite safe to work with the current on. He could not say whether Black knew or not that the current was on.

Percy McDermott, chief electrical engineer at the colliery, said he thought that the fact that the deceased kept in contact with the switch for some moments showed that he thought the current was off.

Medical evidence having been given that death was due to electrical shock, a verdict was returned that Black died from such shock accidently received while examining machinery. The jury also suggested that in future it would be better to have the current turned off when such work was being done.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. R. B. Leach, electrical engineer to the Turton Council, has been appointed consulting electrical engineer to the Swinton and Pendlebury Council, to advise it upon the future of its electricity undertaking, &c.

With reference to a note that appeared in this section in our issue of January 26th, Mr. F. H. Edwards asks us to state that he has not gone to be chief electrical engineer of the Cornwall Electric Power Co., but station superintendent at Hayle.

The Stoke-on-Trent T.C. has appointed Mr. Jas. Machin, of Chesterfield, as mains superintendent at Burslem.

The Erith U.D.C. has appointed Mr. R. N. Mayne, assistant engineer at the St. Helens electricity works, as chief assistant engineer. The salary is £200 a year, and there were 108 applicants.

The Bridlington T.C. has decided to increase the salary of Mr. A. J. Beckett, electrical engineer, from £300 to £350 per annum. The Committee had recommended an increase to £350 with further increases of £25 a year on January 1st, 1913, and January 1st, 1914, on Mr. Beckett agreeing to forego, for work done after the end of 1911, any commission to which, as consulting engineer, he would otherwise have been entitled. An amendment that the increase granted should include work done in connection with any other committee of the Corporation was rejected by 13 votes to 7.

As a mark of appreciation of the able and efficient way in which the electrical engineer (Mr. Brydges) has fulfilled his duties, and of the success which the electricity undertaking has attained since his appointment, the Eastbourne T.C. has decided to increase his salary of £500 by £25 per annum from April 1st next by annual increments of £25 on approved service, to £600 per annum.

At the request of the charge engineers the Electric Lighting Committee of Leyton U.D.C. has decided that the maximum of the present scale applicable to this position shall be increased from £150 to £156.

The Parliamentary and General Purposes Committee of St. Pancras B.C. have recommended that the salary of Mr. J. T. Baron, resident and supervising engineer at the electric light stations, be increased from £450 to £475 per annum, and further increased in 12 months' time to a maximum of £500 per annum.

The Bristol City Council on January 30th discussed the proposal to increase certain salaries in the electricity department. Alderman Pearson, who moved the adoption of the Committee's recommendations, said that Mr. Faraday Proctor had been for 10 years without an increase, and it was proposed now to raise his salary from £800 to £850. The discussion was lengthy, and while there was almost a unanimous eulogy of the chief engineer, it was resolved, on a division, by 35 votes to 32, to omit his name from the resolution.

The maximum salaries of the engineers-in-charge at the electricity works of Salford are to be increased from £180 to £190 per annum, and the three present engineers are to have their salaries increased to meet this resolution.

Mr. R. J. Watmuff has resigned his position as shift engineer at the Rawtenstall electricity works in order to take up a position of draughtsman with Messrs. Greens, engineers, Cononley. Mr. Nicklin, of Falkirk, has been appointed to fill the vacancy.

On Monday afternoon, Mr. W. B. Clarke, shift engineer at Kirkcaldy, was presented by the staff with a handsome dressing case and Gillette safety razor case, on the occasion of his leaving to take up a situation in South Africa. The presentation was made by Mr. O. F. Francis.

Tramway Officials.—In view of additional work that has devolved upon certain officials, and in recognition of efficient performance of their duties, the Birmingham Corporation Tramways Committee has recommended the following advances of salary:—Mr. C. E. S. Bill (permanent way engineer), from £300 to £350 per annum; Mr. R. H. Dickinson (rolling stock superintendent), from £300 to £350; Mr. A. C. Baker (electrical engineer), from £200 to £250 per annum.

Accrington Electricity Committee has adopted a resolution to dispense with the services of Mr. James Wilding, the overhead linesman, under the new management. Mr. Wilding has been offered £50, with one month's notice, to terminate his services. In the event of non-acceptance, he will be given a month's notice without compensation. The Committee considered the position of Inspector Dutton, whose services are also not now required. It was resolved that he be given notice to terminate his services, a sum of £20 being given as compensation for loss of office.

General.—MR. J. H. BIGLAND, of the National Telephone Co.'s London contract staff, has been appointed contract manager to the Constantinople Telephone Co. (Société Anonyme des Telephones de Constantinople), and will shortly proceed to Constantinople to take up his duties.

MESSRS. G. J. WELLS & A. J. WALLIS-TAYLER have commenced business as consulting engineers at 78, Fleet Street, London, E.C., as Wells & Tayler. Mr. Wells, who served his time with Messrs. Thornycroft, has since held positions on the staffs of Messrs. Willans & Robinson, Easton, Anderson & Goolden, the British Westinghouse Co., and Yates & Thom. Mr. Tayler served his time with a well-known firm of saw mill engineers, has had a considerable experience in charge of extensive sugar estates and works in the West Indies, and for a number of years has devoted himself to the subject of refrigeration, upon which he has written several text-books.

MR. G. A. TRUBE, who has been associated with the British Westinghouse Co. since its inception in this country, lastly as manager of the engine sales department, has just resigned this position to take up the managership of the Société Anonyme Westinghouse, of Paris and Le Havre. Mr. Trube, whose address henceforward for all business communications will be 7, Rue de Berlin, Paris, has, in addition to his Westinghouse connections, a host of friends in the engineering world, and he will start out on his new enterprise with the good wishes of them all.

MR. J. KELLY, who is retiring from the position of senior in charge of the tool department of the Western Electric Co., North Woolwich, has been presented by the employés with a gold watch.

Indian Engineering says that "MR. T. D. D. BERRINGTON, C.I.E., M.I.E.E., Director-General of Telegraphs, Indian Telegraph Department, is permitted to retire from the service of Government."

We are asked to state that the dissolution of partnership hitherto existing between MR. G. HOOGHWINKEL and MR. THURSFIELD, of Leeds, does not in any way affect the partnership of Mr. Hooghwinkel and MR. WM. ANTHONY BROWN, who are continuing to carry on business as civil and electrical engineers at 24, Martin's Lane, Cannon Street, E.C., and at Mexico City and Rio de Janeiro.

Obituary.—The death took place at Woodford, Essex, on Sunday last, of MR. P. M. S. BRODIE, who, for the past 11 years, was works manager of The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E. He joined the company nearly 40 years ago, and had been manager of the Sheffield, Bradford and Glasgow branches. He was in his 65th year.

NEW COMPANIES REGISTERED.

Fox, Ltd. (119,891).—This company was registered on January 26th, with a capital of £1,000 in £1 shares, to carry on the business of equippers of private houses and other premises with plant and accessories for supplying light, heat and power, manufacturers of electrical heating and regulating devices, machinery, accessories, &c. The subscribers (with one share each) are:—J. Fox, 43, Clifton Road, Aston, Birmingham, mechanic; R. J. Hall, 28, Douglas Road, Handsworth, Birmingham, insurance superintendent. Private company; the number of directors is not to be less than two or more than five; J. Fox is the first; qualification, £100; remuneration as fixed by the company. Registered office, 28, Temple Row, Birmingham.

Hydro-Electric Lift and Crane Co., Ltd. (119,852).—This company was registered on January 24th, with a capital of £600 in 2s. shares, to carry on the business of lift and crane makers, hydraulic engineers, electric supply engineers, makers, builders and erectors of hydraulic and electrical machinery, &c. The subscribers (with one share each) are:—E. M. T. Boddam, 27, Old Jewry, E.C., engineer; H. B. Vogel, 27, Old Jewry, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are E. M. T. Boddam and H. B. Vogel; W. B. Townsend is the first secretary. Registered by W. B. Townsend, 27, Old Jewry, E.C.

Brilliant Arc Lamp and Engineering Co., Ltd. (119,811).—This company was registered on January 22nd, with a capital of £2,500, in £1 shares (500 5 per cent. cumulative preference), to acquire from B. A. Quint a licence to manufacture and sell certain inventions and patent rights in regard to electric arc lamps and otherwise, and to carry on the business of founders, engineers, &c. The subscribers (with one ordinary share each) are:—J. W. Begg, 26, Park Road, S. Wanstead, clerk; N. A. Corke, 24, Birdhurst Road, Croydon, articled clerk. Private company. Table "A" mainly applies. Registered office, 1, Lonsdale Road, West Kilburn, N.W.

Venner's Signs, Ltd. (120,015).—This company was registered on February 1st, with a capital of £11,000 in £1 shares, to acquire certain patents relating to illuminated signs and the trade mark "Veni," together with the business of a manufacturer and seller of illuminated signs carried on by R. F. Venner, and to adopt an agreement with R. F. Venner and A. R. Jenkins. The subscribers (with one share each) are:—A. R. Jenkins, 2, Coleman Street, E.C., merchant; R. F. Venner, 6, Old Queen Street, E.C., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are R. F. Venner (chairman), and A. R. Jenkins (both permanent, subject to holding 2,000 shares each), and two other directors to be appointed by them; qualification of ordinary directors 100 shares; remuneration of R. F. Venner as chairman, £150 per annum; of other directors £25 per annum. Registered office, 6, Old Queen Street, Westminster.

Homer Earphone Co., Ltd. (120,026).—This company was registered on February 2nd, with a capital of £1,000, in 900 ordinary shares of £1 each, and 2,000 deferred shares of 1s. each, to take over the goodwill for the British Empire of the business of the Homer Earphone Co., to carry on the business of manufacturers of and dealers in aural, surgical, electrical and scientific instruments, &c. The subscribers (with one deferred share each) are:—J. L. Jones, 76, Selwyn Road, Upton Manor, E., managing clerk; A. R. Hawdon, York Hill, Loughton, Essex, clerk. Private company. The number of directors is not to be more than five; the subscribers are to appoint the first; qualification, 500 deferred shares. Registered by Owen Jones & Co., 85, Fleet Street, E.C.

Fletcher Jackson & Co., Ltd. (119,942).—This company was registered on January 30th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and mechanical engineers, electricians, manufacturers of and dealers in electrical apparatus, &c. The subscribers (with five shares each) are:—A. Fletcher, 89, Hamlet Court Road, Westcliff, engineer; A. G. Jackson, Kingscote, Hodford Road, Golder's Green, N.W., engineer. Private company; the number of directors is not to be less than two or more than five; the first are A. Fletcher (chairman), and A. G. Jackson (both permanent); qualification, five shares. Registered by Wansey Stammers & Co., 28, Moorgate Street, E.C.

Telephone Accessories Co., Ltd. (120,014).—This company was registered on February 1st, with a capital of £1,500 in £1 shares (600 preference), to carry on the business indicated by the title, and that of stationers, advertising contractors and agents, &c., and to adopt agreements (1) with H. O. Quinn and N. Medawar; and (2) with E. C. Digby. The subscribers are:—D. S. Fripp, 90, Cannon Street, E.C., chartered accountant, 50 preference shares; W. P. A. Banks, 101, Bethune Road, Stoke Newington, N., chartered accountant, 25 preference shares. Private company. The number of directors is not to be less than four or more than six; the first are C. C. Tollitt, D. S. Fripp, J. S. Patmore and H. O. Quinn; qualification, 25 shares; remuneration of chairman, £40 per annum: of other directors £20 each per annum. Registered office, 90, Cannon Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brush Electrical Engineering Co., Ltd. (29,533).—Particulars of £75,000 prior lien debentures, created December 28th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and land and buildings at Loughborough and Cricklewood. No trustees.

Bankfoot Power Co., Ltd. (98,134).—Issue on January 16th, 1912, of £2,800 debentures, part of a series of which particulars have already been filed.

Evershed & Vignoles, Ltd. (43,206).—Issue on January 17th, 1912, of £200 debentures, part of a series of which particulars have already been filed.

Rural Electricity Supply Co., Ltd. (107,281).—Particulars of £500 debentures, created January 22nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Blackpool and Garstang Electric Light Railway Co., Ltd. (62,150).—Return dated December 29th, 1911, filed January 1st, 1912. Capital £10,000 in £5 shares; 361 shares taken up; £4 per share called up; £1,707 paid, including £323 received on application for further shares not allotted, leaving £60 in arrears. Mortgages and charges: Nil.

Electrical Installations, Ltd. (91,050).—A memorandum of satisfaction to the extent of £50 on January 9th, 1912, of debentures dated December 5th, 1906, securing £1,500, has been filed.

Allen, West & Co., Ltd. (108 870).—Particulars of £6,000 debentures, created January 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustee.

Dennison, Kett & Co., Ltd. (100,769).—A memorandum of satisfaction in full on January 31st, 1912, of debenture dated January 26th, 1909, securing £500, has been filed.

CITY NOTES.

Metropolitan District Railway Co.

The half-yearly meeting was held on February 1st at Westminster Palace Hotel, Lord George Hamilton in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 189), said, although the traffic had been adversely affected owing to unfavourable weather conditions for underground travel during the summer months, and to the interruptions during the strike, the traffic showed a substantial increase. The employés who went on strike in August last did not do so on account of any dissatisfaction or through any grievance of any kind with the company, but because they were ordered out by their Union officials. A majority of employés were loyal to the company. The total capital expenditure amounted to £51,036, a large part of which had been expended upon new rolling stock required for the rapidly growing traffic. The estimated further capital requirement was £150,000. This sum would provide for additional rolling stock, for a fly-over junction at Earl's Court and for other improvements made necessary by the expanding traffic. The gross receipts showed an increase of £14,800. The receipts from passenger traffic showed an increase of £13,430, of which £6,494, or nearly 50 per cent., was from season tickets. Receipts from first-class traffic showed a small decrease over the corresponding period in 1910, although more passengers were carried. This was due to a slight adjustment in first-class fares made during the half-year, and which partly explained the slight decrease in the average receipt per passenger from 1·84d. to 1·80d. The train service had been substantially improved, as the train and car-mileage showed, but notwithstanding an increase of 498,151 car-miles, equivalent to 7·23 per cent, the earnings per car-mile had decreased only from 9·584d. to 9·409d., which justified the policy of working a rapid and frequent service of trains. To-day they were working, during the heavy hours of traffic, 40 trains per hour, and this number would be increased when improvements, now under consideration, had been effected. Although nearly 2½ million more passengers were carried, and notwithstanding the increase in wages and the additional expense through the strike, and the very substantial increase in rates and taxes, the expenditure side of the account showed a very slight increase. Savings had been effected in the cost of current and in the maintenance of stations. The percentage of working expenses to gross receipts was 47·8. This included interest on the cost of the power house. Assuming that the power house had been built out of capital raised by the company, the interest would not have been included in the working expenses. Deducting the interest from the working expenses, they were

reduced to 41·87, which was a low rate of working, and corresponded with the forecast made when it was decided to electrify the railway. After providing for all fixed charges and setting aside £10,000 for renewals, there remained a balance of £85,491 payable for dividends, an increase of over £22,000. This balance was sufficient to pay a dividend on the second preference stock at the rate of 2 per cent. per annum. This was the first dividend paid on this stock, and he thought they could safely look forward to a gradual increase upon this rate in the future. The £6,250 in payment of a warrant on the 4 per cent. guaranteed stock was the fourth and final payment, and the holders of this stock seemed to him to have good reason to be satisfied with their bargain. The directors had given careful consideration to the subject of depreciation, and, in view of the information from the engineers, they were satisfied that the amount now set aside for this purpose was sufficient. The Lot's Road power house undertaking became vested in the Lot's Road Power House Joint Committee on January 1st, 1912, and was thereupon leased to the company and the London Electric Railway Co. This valuable property, which was most essential to these railways, had therefore become part of the undertakings of these companies. The bargain was a good one for the company, and they would, he was satisfied, profit by this arrangement. The widening of the London and South-Western and this company's railways between Studland Road and Acton Lane Junction, whereby the company secured in perpetuity the exclusive use of separate lines between those points, was practically completed, and was opened for traffic on December 3rd. This improvement had enabled them to make substantial improvements to the service on the lines west of Hammersmith, which ought to prove remunerative. These increases in the service necessitated the purchase of additional rolling stock. In 1908 the company obtained powers to create and issue £750,000 prior lien debenture stock. In the same year they sold to the London, Tilbury and Southend Railway 74 carriages, which it required for working the electric line to East Ham and Barking. For these carriages they received £130,000. When these carriages were sold it was not anticipated that the company's traffic would for some time increase sufficiently to require additional rolling stock, and inasmuch as the £130,000 from the Tilbury Co. was received after the amount required for capital purposes had been fixed and the amount of prior lien stock to be created agreed, the then chairman—Sir George Gibb—stated to the shareholders that this additional amount would not be used before communicating with the debenture-holders and obtaining their consent. Since that time they had issued £550,000 of the prior lien stock, and had used nearly the whole of the £130,000 for purchasing rolling stock to replace that sold to the Tilbury Co. and in improving their old stock. It was now proposed to make a further issue of prior lien debenture stock to replace the £130,000 used for purchasing new carriages, and a meeting of debenture-holders in accordance with the promise given would be held. The company's Bill before Parliament dealt with two important objects. First, with regard to the widening of the London and South-Western Co.'s Wimbledon and Fulham line between East Putney and Wimbledon. By agreement with the South-Western, the company worked a through service of trains to Wimbledon by the Putney line. The line between East Putney and Wimbledon was used jointly, and their company's service was always subject to the requirements of the South-Western. This arrangement restricted and interfered with the company's working, and as the traffic was increasing it had been deemed advisable by both companies that their company should have the free and uninterrupted use of separate lines between East Putney and Wimbledon. A provisional agreement had accordingly been made with the South-Western, who have agreed that their company should seek the necessary powers authorising the widening. The cost of the improvement, estimated at £250,000, would be borne by the South-Western Co., and their company was to contribute as a working expense such a yearly sum not exceeding £4,000 as would, with the increased earnings of the widened lines, make up a sum equal to interest at 4 per cent. per annum on the cost incurred by the South-Western. This was another and important step towards relieving the working of the railway from any interference by other companies' trains, which was absolutely essential for the successful working of the railway. The other subject was with regard to the prior lien debenture stock to which he had previously made reference. When this £750,000 prior lien stock was authorised, the net revenue was not sufficient for payment of debenture interest, and it was then estimated that £60,000 would be required to meet deficiencies in future half-years. Therefore, £60,000 of the total amount created was reserved for this purpose. Fortunately, this provision was far more than had been required, for there had only been one half-year, *i.e.*, June, 1908, when the net revenue was not sufficient to meet the deficiency Only £19,889 of the prior lien stock had been sold for this purpose, leaving a balance of £40,111 out of the £60,000 referred to. It was extremely unlikely that this balance would be required in the future for the special purpose for which it was authorised, and it was therefore proposed to apply this amount to the general purposes of the company. The Bill also sought powers to authorise the company to limit the amount of personal luggage which a passenger might bring on to the railway. Another provision in the Bill was power to the company and the London Electric Railway Co. to supply electrical energy from the Lot's Road power house to the North Metropolitan and Richmond Electric Light and Power Companies. They had a large reserve supply at this station, and it was important that they should find customers for its use. The Great Eastern Co.'s Bill sought power on behalf of the East London Railway for the electrification of that line and to empower the Great Eastern Co. to raise, by the issue of 4 per cent. debenture stock, a sum not exceeding £90,000 to cover the cost of electrification and to confirm an agreement between the East London Co. and the six lessee companies. The District Co. was one of the lessees and, as the net receipts from the line were insufficient to meet the annual rental of £30,000, they were required to make good its share of the loss. The lessee companies were hopeful that by electrifying the line and reinstating a through service of trains and improving the service generally, the receipts would increase sufficiently to justify the cost of electrification. He would say a few words as to their past and future. Three years ago the profits available for the half-year ending December, 1908, after paying fixed charges, were £11,612; now they were £85,500. They were then only able to pay 1¾ per cent. on the guaranteed stock; now they paid the full 4 per cent. upon that stock, the full 4½ per cent. upon the first preferred, and 2 per cent. on the second preferred stock. They had achieved these results mainly from the remarkable and continuous improvements effected in the speed, multiplication and regularity of the service. The highest credit was due to the staff for these improvements, and they had been achieved by assiduous and unceasing attention to every detail of the traffic and to anything that could conduce to the comfort and safety of the passengers. Whilst, therefore, they could contemplate the immediate past with some satisfaction, they had good reason for believing that the various schemes in course of promotion by the Underground Co. (who were by far the largest stockholders in their company), in addition to what they were doing themselves, ought not only to expand their existing *clientèle*, but ought also to open up fresh sources of profit in the future of the company.

MR. W. H. BROWN seconded the motion, and the report was agreed to without discussion.

An extraordinary meeting was afterwards held, when a resolution was passed approving of the company's Bill in Parliament.

Replying to MR. LUMB, the CHAIRMAN said the company had everything to gain, and nothing to lose by the proposed arrangement with the omnibus company.

Liverpool Overhead Railway Co.

THE directors' report for the half-year ended December 31st, 1911, shows that the gross revenue receipts amount to £40,791, and the working expenses to £27,688. The number of passengers carried during the last two years is as follows:—

	Half-year ending			
	June, 1910.	Dec., 1910.	June, 1911.	Dec., 1911.
First class	546,742	567,911	579,328	617,097
Third class (including tramways)	3,013,785	3,260,261	3,113,073	3,398,069
Workmen (special return tckts.)	1,529,553	1,563,128	1,701,196	1,723,340
Total ..	5,090,080	5,391,300	5,393,597	5,738,506

The traffic again shows a satisfactory increase in all classes, notwithstanding the railway strike in August last. The revenue account shows that the receipts from passenger traffic amount to £39,361, plus miscellaneous receipts and interest £1,430, making £40,791, less working expenses and transfer to renewal fund £27,688, leaving £13,103. Deducting interest on mortgage debentures and on calls paid in advance, £4,329, leaving £8,774, and adding the balance brought forward, £4,665, there remains available for dividend £13,439. Out of this balance the directors recommend the declaration of dividends at the rates of 5 per cent per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, payable on and after February 16th next, leaving a balance of £4,763 to be carried forward.

London Electric Railway Co.

THE half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, Lord George Hamilton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 186), said that the expenditure on capital had amounted to £16,465, mainly for the cost of the Charing Cross and Paddington extension and the addition to rolling stock and equipment. The estimated further capital expenditure was a rather larger figure, and amounted to £530,000, but this was mainly for the two extensions for which they were asking Parliamentary powers, and it ought to be a source of additional profit to the company. It also provided for the installation of escalators at Oxford Circus Station and for other small improvements to the undertaking necessitated by the increased traffic. The gross receipts showed an increase of £13,295. A satisfactory feature of the report was the growth of the season ticket traffic. The traffic was adversely affected by the extraordinary fine weather in the summer months, and also by the general strike in August last. In connection with the strike he was glad to have the opportunity of expressing the appreciation of the board of the excellent services rendered by those in their employ who remained loyal to the company, and he was happy to say that they were in a very large majority. He should like particularly to mention the drivers, who were almost universally loyal and maintained the service practically free from any interruption. With regard to the few men who did come out on strike, it was not because they had any grievance against the company, but because they were ordered to do so by their Unions. It was to be regretted that the men should do anything to prejudice the undertaking in which they had a substantial interest, without reason for so doing. Working expenses showed a slight increase due to the rise in the rates, amounting to £5,290, which was due to their increased property. Repairs and renewals to the rolling stock showed a slight increase. The ratio of working expenses to gross receipts was only 46·68 per cent., and if the interest charges in connection with Lot's Road station were

deducted, the ratio was reduced to 41·76. It was proposed to pay the full dividend at the rate of 4 per cent. on the preference stock, and of 1 per cent. on the ordinary shares. The dividend for the corresponding period of last year on the ordinary shares was at the rate of ¾ per cent., so that they had shown some improvement this year by paying 1 per cent. The number of passengers carried exhibited some remarkably large figures. Last half-year they carried 48,566,000 persons, and in the preceding six months 52,545,000, or in the 12 months over 101 million passengers. Those huge figures gave some idea of how their undertaking contributed to the convenience and economy of a vast number of persons living in London. Having referred to the new arrangements for Lot's Road power house, the chairman said that by the company's Bill it was proposed to make two important extensions of the railway. One was from the authorised extension of the Baker Street and Waterloo line at Paddington Station, through Paddington to Queen's Park Station on the L. & N.W. Railway, where a physical junction would be made with that company's electrified line to Watford. When that extension was accomplished, a service of electric trains could be run from the Elephant and Castle to Watford. A provisional arrangement was being made whereby the L. & N.W. Railway would pay for the cost of the construction and equipment of this extension, and for the rolling stock necessary for working the through service. The rolling stock required for the local service would be paid for by their company. The district which would be served by the extension was densely populated, and required additional railway facilities. The extension, however, would not depend alone on the local traffic, since the connection at Queen's Park with the L. & N.W. system would bring a large and constantly growing traffic to the line. A scheme to connect up the tube railways with the electrified suburban system of a large steam railway company was a new departure for tube lines, and undoubtedly would be not only a convenience, but would rapidly develop the districts served. The other extension was the amalgamation of the Euston and Hampstead Railway Co. with their company. That railway had been authorised for seven years, but no part of it had been constructed. It would serve a territory which, given proper facilities, would develop very rapidly, as was illustrated in the case of Golder's Green. The line would be an extension of the Charing Cross, Euston and Hampstead Railway from Golder's Green to Edgware, a distance of 4½ miles. The additional capital asked for in the Bill was £700,000. They attached considerable importance to both those extensions. A steady centrifugal movement of the population of London was taking place—the population in the central sections was diminishing, but, on the other hand, it was growing with increasing rapidity in outer London. A visit to Golder's Green would illustrate the dimensions which that movement had attained. The future prospects of their company depended more, perhaps, on the outer than upon the inner circle of London population, and they were, therefore, shaping their course accordingly.

Sir Algernon West seconded the motion.

Mr. Walford asked whether it would be possible to arrange for a subway at Holborn to give access to the Central London Railway.

The Chairman said they must remember that subways were costly things, and also that the stations at that point were not on the same level.

The report was adopted.

The following Bills were submitted for the consideration of the proprietors at a special general meeting held immediately after the ordinary meeting, viz. :—

"A Bill to empower the London Electric Railway Company to construct new railways; and for other purposes."

The additional capital sought by the Bill is £700,000 with the usual borrowing powers.

"A Bill to make further provision respecting the undertaking of the Metropolitan District Railway; to empower the London and South-Western Railway Co. to widen their Wimbledon and Fulham Railway; to confirm the agreement between those companies with reference to that railway; and for other purposes."

Bristol Tramways and Carriage Co., Ltd.

The directors' report for the year ending December 31st, 1911, states that the gross receipts amount to £335,738, and the working and general expenses and renewals to £270,574, leaving a net revenue of £65,164. From the net revenue the following amounts have been distributed, viz. :—Interest for the year on 4 per cent. mortgage debenture stock, 4½ per cent. mortgage debenture stock and on deposits and bankers' interest, £22,501 ; dividend on 4 per cent. preference shares for the year (subject to income-tax), £18,833 ; interim dividend at the rate of 4 per cent. per annum (subject to income-tax), for the half-year ending June 30th, £9,417 = £50,751, and it is proposed to appropriate the balance as follows :—Final dividend for half-year at the rate of 4 per cent. per annum (subject to income-tax), £9,417 ; addition to reserve fund for contingencies and renewals, £4,997 = £14,413. The interest on investments has been carried direct to the credit of the reserve fund, thus raising that fund to £216,234. The values of the securities have as usual been adjusted to market prices at December 31st. With the addition now proposed of £4,997, the reserve fund will be further augmented to £221,231. The receipts from the tramways department show an increase of £7,472, or 3½ per cent., whilst those of the carriage department have increased by £18 084, being no less than 20 per cent. The total number of passengers carried during the year on the company's cars and omnibuses was 49,561,001, as compared with 47,454,560 in the previous year, an increase of 2,106,441. Additional motor omnibus routes have been opened during the past year with satisfactory results, whilst the policy of developing the company's general motor carriage business has also been attended with much success. A number of leading firms in London and the provinces, are already hiring motor vehicles for commercial purposes from the company, and a further number of such vehicles of varying tonnage are now being built to supply the growing demand. The expansion of all departments in Bath and Weston-super-Mare has continued throughout the year. The work of relaying the tramway lines in Bristol has been steadily proceeded with during the past year and a further mileage will be similarly dealt with this year. The Bill promoted by the company in the last session of Parliament to further extend the time for the construction of the remaining authorised extensions, received the Royal Assent on August 18th, 1911.

Company Registrations in 1911.—The *Investors' Guardian* in reviewing the statistics of company registrations in 1911, publishes the following comparative figures :—

English Registrations.	1909.	1910.	1911.
Electric	£3,253,920	£2,408,457	£3,166,645
Engineering and hardware	9,638,343	5,889,442	8,424,402
Gas	919,500	1,013,362	838,125
Motor, cycle and carriage	4,225,299	3,293,050	2,721,345
Railways and tramways ...	2,931,740	9,952,660	5,186,855
Rubber	13,736,014	44,046,045	9,458,775

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared for the year to December 31st a balance dividend of 1s. 3d. per share, £3,650 being transferred to the general amortisation fund, and £76 carried forward.

Central Electric Supply Co., Ltd.—The report of the directors for the year ending December 31st, 1911, states that energy has been supplied to the Westminster Electric Supply Corporation, Ltd., and the St. James' and Pall Mall Electric Light Co., Ltd., throughout the year, to an amount of 18,102,440 units. After making a full allowance for sinking fund and depreciation the net balance for the year 1911 is £4,978, plus £27 brought forward. The directors propose to pay a dividend at the rate of 5 per cent. on the ordinary shares for the year absorbing £5,000, and to carry forward £5. The directors regret the death of Mr. Edmund Boulnois, the deputy chairman, and Captain Edmund I. Bax has been elected a director during the year.

National Boiler and General Insurance Co.—The directors have declared an interim dividend of 6s. per share, free of income-tax, on the ordinary shares for the half-year ended December 31st.

National Gas Engine Co., Ltd.—The directors have presented the first accounts of the company as reconstituted. They cover the period from June 30th (when the old company terminated its existence) to December 31st, 1911. After providing for salaries of administration, and for depreciation of buildings, plant and machinery, the profit for the period amounts to £43,369. The new company did not obtain its certificate to commence business until September 2nd, and the directors are advised that the profits earned prior to that date (from June 30th) cannot be legally disposed of in the way of dividend. It has, therefore, been decided that the sum of £8,800, being the estimated profit during the period mentioned, be placed to reserve account. This will leave an amount of £34,569 available for disposal. It is recommended that this sum be applied as to £6,000 to the payment of a dividend at the rate of 5 per cent. per annum in respect of the preference shares, and as to £22,500, in the payment of a dividend of 9d. per share on the ordinary shares, both less income-tax. These payments will, subject to directors' remuneration, leave £6,069 to be carried forward. The directors purpose holding the annual general meeting of the company in February of each year.

Great Northern and City Railway Co.—The half-yearly meeting was held on January 31st, Lord Lauderdale presiding. In moving the adoption of the report (see Electrical Review, page 190), the chairman said that the new subway from the company's station at Moorgate Street to that of the Metropolitan Railway Co. would be finished during the current half-year, and the easier access thus provided would increase the flow of traffic. The passengers carried during the half-year, as compared with the corresponding half of the previous year, were 6,119,506, as against 5,856,829. During the last three years the receipts from passengers had been £74,600 for 1909, £75,000 for 1910, and £78,500 for 1911. The average receipt per passenger during the same three years was 1·53d., 1·52d. and 1·51d. respectively, while working expenses were 52·91 per cent. of revenue, 50·60 per cent. and 49·82 per cent. Economy had been steadily and uniformly exercised. The gradual reduction of the efficiency in the company's accounts was encouraging. In the three years it had been £8,900, £7,000, and for the last year £4,300. The chairman said that this improvement had been effected in spite of strenuous competition of the L.C.C. tramways. During the busy hours of the day the railway was running 40 trains per hour. Though they were taking no part in the amalgamation of the tubes and the L.G.O., they were naturally watching it with sympathetic interest. The report was adopted.

Urban Electric Supply Co.

An extraordinary general meeting of the above company was held at Salisbury House, E.C., on Friday, under the chairmanship of Mr. Tuckett, for the purpose of considering a series of resolutions having for their object the rearrangement of the capital of the company. The object of the resolutions was given in the last issue of the Electrical Review.

The Chairman said that the meeting had been called in order to deal with a situation which unfortunately existed and had to be faced. For some years it had been obvious that the position of the company on the expiry of Edmundson's guarantee would be such as to call for some sacrifice on the part of the shareholders, and on more than one occasion he had explained the main causes which had brought about this disappointing result. He intended, therefore, to-day to restrict his remarks to that which constituted the essential business of the meeting—viz., the consideration of the present position of the company and of the scheme for dealing with it. In considering the position, three main features stood out prominently:—(1) The profits were inadequate; (2) the assets were depreciated; (3) the capital resources were insufficient. The inadequacy of the profits was the feature which probably concerned them most directly, and he was therefore glad to be able to assure them once more that, in their opinion, it was only a question of time and careful administration for this deficiency to be largely made good. The business showed every indication of steady development, and no care or effort would be wanting on their part to ensure from such development a satisfactory increase of profit. In the meantime, their estimates of profit for the past year, for the current year, and for next year, only admitted of the payment of cash dividends on the preference shares of 2 per cent., 3 per cent., and 4 per cent. respectively for those three years. There was, however, nothing in the resolutions before them to prevent their paying larger cash dividends in respect of those years, should the circumstances warrant it; but he was bound to say that he thought it was most improbable that they would be in a position to do so. On the other hand, he felt no serious anxiety as to their ability to pay the minimum dividends mentioned, although they must, of course, be dependent on their estimates being approximately realised. In any event, however, they remained cumulative, and it was only in respect of the balance of the dividends for those three years that they were asking the preference shareholders to modify their cumulative rights. These balances, amounting to £15,000 in all, they proposed to satisfy by certificates redeemable at the rate of £1,250 per annum out of the first profits of each year after payment in cash of the full preference dividend for such year and before payment of any dividend on the ordinary shares. The second of the three prominent features to which he had alluded was the depreciation of their assets, and this arose from two causes—one largely temporary, the other permanent. The temporary cause was the present low earning capacity of a considerable portion of the capital, and it was this which was principally responsible for the low market value of the shares. The second cause was the permanent depreciation in value, to a large extent arising from their inability during the past 10 years to make more than a nominal provision for depreciation on a total capital expenditure of over £1,200,000, and it was with this that they were concerned in their proposal to reduce the capital by writing £2 per share off the 80,000 ordinary shares. They believed that the majority of the shareholders would prefer to deal with the situation by accepting the loss and getting rid of it in this way rather than by making it good in the only way in which it could be made good, namely, out of revenue. It was true that in the present uncertainty of the law on the subject it could not definitely be laid down that depreciation of assets in the case of a company like theirs necessarily precluded the payment of dividends, but there was no question that until this essential charge on revenue had been met, there could be no profits in any true sense of the term, and he thought it would be generally conceded that where there was such undoubted depreciation as existed in their case, the board would incur a grave responsibility if they were to continue the payment of dividends without in any way providing for it. Permanent depreciation of capital, particularly where it was accompanied by a lack of earning capacity, could not safely be ignored, if a company was to go forward with confidence in its future, and they felt sure that it was in the best interests of both classes of shareholders that they should make the sacrifices which they were asked to make in order to bring the balance-sheet into closer conformity with the actual position. In neither case was the sacrifice really great, whilst in both cases the gain was substantial. They would readily understand that in arriving at the figure of £160,000 as the proper amount to be written off, it was impossible for them or anyone else to say with certainty that that figure represented the exact amount of the existing permanent depreciation, but they were satisfied that it was as close an approximation to the exact amount as could be made, and it was consequently the amount which they recommended the shareholders to write off. If this amount was written off, they believed that they would in due course be able to pay a reasonable dividend on the reduced ordinary share capital without impairing the adequacy of the annual reserve provision necessary to maintain the capital intact. They were proposing to deal with this sum of £160,000, by which the capital would be reduced, in a somewhat unusual manner. Instead of applying it at once in its entirety to the writing down of the assets, a course which it would be both difficult and undesirable for them to adopt, they proposed to write off only those capital losses which had actually been ascertained, such as the item of £9,586 appearing on the last balance-sheet as "Suspense account for loss on wiring and motors on hire and plant dismantled," and to carry the balance to a capital reserve fund against which the existing depreciation could be written off from time to time as it materialised. In adopting this course there was no intention to relieve themselves of the obligation to provide for future depreciation or to throw on this fund the burden of charges properly falling on future revenue. It was essentially a fund to provide for a potential loss which already existed, but of which only a small part had yet been realised. And this brought him to an aspect of the case to which it was desirable that he should call their attention. So far as he was aware, there was no precedent of an electric supply company having reduced its capital, and owing to the powers of purchase possessed by the local authorities the case was in this respect distinct from that of any other industrial undertaking. Now it was sometimes argued that, because they were liable to purchase, it was therefore impossible for them ever safely to reduce their capital, and that for the same reason it was impossible for them to know whether they had in fact lost any of the capital until they saw the outcome of the ultimate purchase by the local authorities. There was, of course, a certain substratum of possibility underlying this argument, and in an age of miracles it might be that their plant would be worth twice as much 30 years hence as it was to-day, or that the local authorities would elect to purchase at an early date, on a 6 per cent. basis, undertakings which at present, and for some time to come, were likely to yield only 2 per cent., 3 per cent., or 4 per cent., but he thought they would agree that these were not the sort of possibilities on which practical business men were justified in building their policy, and even if the possibility of their assets some day realising something more than the figure they now placed on them was somewhat less remote, he still thought that that afforded an insufficient reason for burdening the company indefinitely with a weight of dead capital. Similarly, with reference to the danger of prejudicially affecting the purchase value of their undertakings by a reduction of their capital, they were advised, and were certainly of opinion, that in their case and dealing with the matter in the way they proposed, the reality of the danger was easily exaggerated. Because the shareholders in a company operating 23 provisional orders decided for their own convenience, and as a matter of internal arrangement, to write down their capital by £160,000, and to appropriate that sum to a special capital reserve fund, it was surely very difficult to argue that that was going prejudicially to affect the "then value" of any particular undertaking some 30 years hence, nor in the event of purchase in the intervening period "as a going concern," or on the basis of "capital expenditure plus a percentage," could they believe that there was any serious risk involved, and indeed they were so advised. He now came to the last of the three prominent features to which he had referred, viz., the insufficiency of their capital resources, and for this the scheme provided by increasing the board's borrowing powers and by creating additional share capital. The position, so far as the borrowing powers were concerned, was stated with sufficient clearness in the circular accompanying the notice, but he proceeded to briefly re-state it. It was only by the judicious expenditure of capital that they could substantially increase their profits, and if the shareholders were to deny them the resources which the additional capital could provide, they would have no alternative but to withhold the payment of dividends. With these additional resources, however, they had no doubt of their ability to provide for the company's financial requirements for many years to come, whilst they were equally confident that they would enable them to attain for the company a position in which its profits would show a satisfactory return on the reduced ordinary share capital. They need have no fear that the grant of these additional powers would tempt them to be improvident or that the administration of the company's finances would be any less careful than would otherwise be the case. The powers were required to secure the future, not to enable them to embark on a policy of adventure. The new capital would only be issued as and when required by the growth of the company's business, and there was no expectation of their having to issue any part of it for some years. The chairman then dealt with the proposed alterations in the articles of association, dealing with each article, and continuing, he referred to the general merits of the scheme, and to the question of its fairness as between preference and ordinary shareholders. The outstanding feature of the scheme was its extreme simplicity and the small extent to which it disturbed the existing rights of the shareholders. Indeed, so much was this the case, that it might possibly occur to some that it did not go far enough, that it would be more valuable if it were more drastic. To such criticism his answer would be that they had to deal with the position as it existed, and that without injustice to the shareholders the position did not warrant their dealing with it in a more drastic way. By the adoption of more drastic proposals they might, no doubt, have found a shorter road to an ordinary dividend, but any such goal could only have been attained by a correspondingly increased sacrifice on the part of the ordinary shareholders, and by a needlessly extended interference with the rights of the preference shareholders, and for neither of these could they see that there was any valid or adequate reason, for the scheme before them completely fulfilled all the objects they had in view. The proposed capital reduction provided for existing capital depreciation, and, combined with the later financial provisions, justified the continued payment of the preference dividend and the earlier payment of an ordinary dividend than would otherwise be the case. The deferred payment of part of the preference dividend for the years 1911, 1912, and 1913, got over the difficulty resulting from the temporary deficiency in the profits, whilst the financial provisions were required to make good the insufficiency of their capital resources, and thereby to safeguard the future. In estimating the merits of this scheme, and generally in considering the financial

position of the company, they wanted to bear in mind the fact that they had Edmundson's behind them. They were, fortunately, so largely interested in the company that they could always rely on their assistance, and that constituted a factor of the situation of the utmost importance to them. The speaker next referred to the sacrifices which the ordinary and preference shareholders were respectively asked to make. In the board's view, in a case like this capital reduction properly fell on the ordinary shareholders, and on the ordinary shareholders alone, and in agreeing to extinguish £160,000 of their capital, they did little more than decide to abandon what was already lost, in preference to the alternative course of making good such loss over a series of years at the expense of future dividends. Nevertheless, in agreeing to the scheme, the ordinary shareholders were making a real and substantial sacrifice for the benefit of the preference shareholders, which amply justified the very slight sacrifice the latter were being asked to make; for, apart from the definite abandonment of £160,000 of capital, they were, under the scheme, agreeing to the payment during the next five years of some £50,000 in dividends to the preference shareholders, the withholding of which would not only have given the company the use of this money without interest, but would also have relieved it of the necessity of raising that amount of capital on more onerous terms than were likely to be exacted five years hence, when the position and financial standing of the company should be much improved. In other words, by accepting the scheme, and thereby enabling payment of the preference dividends to be continued, the ordinary shareholders were likely to be worse off by over £15,000, than would be the case were the dividends to be withheld. If, therefore, the preference shareholders had been asked to forego altogether the whole of the £15,000, the payment of which it was proposed to postpone, they would still have had the best of the bargain, so far as the actual cash sacrifice was concerned. As it was they were being asked to consent merely to the postponement of the cash payment of a few shillings per share of dividend, which must in any other event be postponed for a still longer period. The sacrifice which they were being asked to make, could not, therefore, well be less, and some sacrifice on their part was required, if this or any other scheme was to be carried. No one questioned the right of the preference holders to be paid their arrears of cumulative dividends before the ordinary shareholders were entitled to participate in the distribution of profits, but he more than questioned the wisdom of their insisting on a strict adherence to their strict legal rights. Were they to do so, instead of enjoying the continued payment of dividends, with the prospect of seeing the price of their shares standing between 4 and 5 some two years hence, they would deprive themselves of dividends for an indefinite period, and probably for some years to come would see the price of their shares standing as low, or lower, than it did to-day; and when that time came, instead of being better off, he had very little doubt that most of them would be only too ready to accept very much less satisfactory terms than those now proposed. Apart from the increase of borrowing powers, which was essential, it was a matter of comparative indifference to the board, as a board, whether they decided to adopt the scheme, and thereby admit of the continued payment of dividends, or whether they decided to reject it and so forego the payment of dividends until the capital depreciation had been made good. As individual shareholders, however, they should much regret the rejection of a scheme which had been most carefully thought out, which was essentially fair and which would undoubtedly tend to strengthen and generally improve the position of the company. The chairman then moved the adoption of the resolutions.

Mr. H. B. Grotrian seconded the resolution.

Mr. Hedges generally approved of the scheme, but read a letter from a large shareholder who suggested there was a chance of the new capital being issued to nominees of the directors at a large discount. He also questioned the advisability of altering rule 48, by which directors who had interests in other companies might vote where contracts were being entered into with such companies.

Replying to these and other questions, the Chairman said the company could not issue shares at a discount. They could pay a commission up to 20 per cent. for underwriting. If the article was retained by which all new capital must be offered to the shareholders, the company might be prejudiced. If such capital was so offered, and the shareholders did not take it up, obviously they could get far less favourable terms when they went to a financial house. At the same time, if the board thought the shareholders would take up the capital, naturally they would give them the chance. The power with regard to the voting was really necessary, as the directors were also directors of the companies associated with them, and contracts were frequently entered into between these companies.

The resolutions were then carried.

Owing to there being only 64 persons present, the separate meeting of the preference shareholders stood adjourned for a week at the same time and place. By the articles 72 preference shareholders were required to be present.

Metropolitan Railway Co.

The half-yearly meeting was held on Wednesday, January 31st, at the Great Eastern Hotel, Liverpool Street, E.C., Lord Aberconway presiding.

In moving the adoption of the report (see Electrical Review, page 189), the Chairman said that the expenditure showed a decrease of £4,358, notwithstanding that it included about £2,600 special expenditure in connection with the strike of last August, and about £2,000 for improvements in the electrical rolling stock. There was a reduction of about £9,000 in rates and taxes. The receipts showed very satisfactory increases in merchandise, mineral and parcels traffic, but there was a falling off of £9,000 in passenger receipts. That was due to four causes:—The increase in the motor-'bus and tram competition; the very large falling off in the attendance at the Shepherd's Bush Exhibition, due, no doubt, to the large number of other attractions there were in London during the Coronation year; to the partial suspension of the train services for several days in August in consequence of the strike; and to the exceptionally hot weather of July and August last, which was all in favour of surface conveyance as against underground. They were placing £5,000 to the electrical renewal and depreciation fund, as against £10,000 in the corresponding period. As explained six months ago, they regarded £10,000 per annum as a sufficient provision for electrical renewal purposes under present circumstances. When they had paid for the renewal of their generating plant which was now going on at Neasden they would still have about £50,000 left to the credit of this fund, and that appeared to them to be a quite sufficient nucleus, seeing that they would then have not only a practically new installation, but one that produced current in far greater quantity and at a much lower cost than the old one that it replaced. After debiting the cost of the strike to the general reserve fund, this still stood at about £60,000. For each half-year during the last three years they had been able to show a small advance in the dividend, and the improvement in their position, though not rapid, had been sure, and there appeared to be every prospect of it continuing. He had had some figures prepared showing their receipts, expenses, &c., for each year since 1907. The total receipts from all sources in the latter year were £807,452, and last year they were £902,586, showing an increase of £95,134. The working expenses in 1907 were £385,000, and in 1911 £391,000, an increase of only £6,000, so that they had earned £95,134 additional for the expenditure of only £6,000 more. The percentage of expenses to receipts had fallen from 55·59 to 49·07, and the expenditure per train-mile had fallen from 2s. 4·1d. to 1s. 11·9d. Those figures showed not only that they had been successful in adding to the revenue, but that they had kept the expenditure well in hand, and were working much more economically than they were a few years ago. Dealing with some of the works they had in hand, he would refer first to the renewal of their electrical machinery at Neasden now taking place. They had two of the reconstructed machines already in use, and there was every prospect that when the final details in connection with them were finished they would come fully up to their expectations. So far they had enabled them to reduce the consumption of coal per unit of current produced from about 3·3 lb. to 2·9 lb., which was a considerable item when it was borne in mind that their output of current was now over 160,000 units per day. This was very satisfactory, and the saving would form a very valuable set-off against the higher price they were now having to pay for fuel. The cost per unit of current produced, exclusive of interest on capital, was now just below one farthing. This was a very low figure, and compared favourably with almost any other power station in and around London. They had entered into a contract for the ensuing 12 months for their power house coal, and had had to pay over 1s. per ton advance. Although coal was costing them more, they had turned out current at the lowest cost at which they had yet produced it since their power station had been in operation. That was almost entirely due to the economies effected in the new plant, and also to the great care that they took in getting the very best possible fuel for their purposes. The traffic to and from their outlying districts, namely, on the Aylesbury and Uxbridge lines, continued to grow in a satisfactory manner, and it had become evident that they must take some steps for improving their facilities for dealing with it. As he stated at the last meeting, they had ordered four new trains of the latest type of compartment stock for the longer distance traffic, and these trains were now being delivered, and were being put into work as they came. To keep pace with the competition they would have to put themselves in a position to run their trains from these lines without stopping between Harrow and Baker Street, and so on to the City. It was physically impossible to do this over their existing two pairs of rails if they were to keep up an adequate service to meet the ever-increasing 'bus competition to and from the intermediate stations. They were therefore seeking powers in the ensuing session of Parliament to widen the railway for a distance of nearly 3¼ miles between Finchley Road and Wembley Park with a view to providing express lines between those points for the accommodation of the trains from Harrow and beyond. The engineering works that they had in hand at the present time were all proceeding satisfactorily, and in one or two cases they were fast approaching completion. The new arcade at Liverpool Street Station would form a short cut for foot passengers between the Bishopsgate Street end of Liverpool Street and New Broad Street. The 25 or 26 shops they had built in the arcade would command substantial rents, and a considerable number of them were already let. It was by the development of valuable building sites like this that they had increased the company's rentals from £65,287 in 1907 to £76,443 in the past year. At King's Cross the new station buildings on the street level had been brought into use, and they hoped very soon to have the works on the platforms completed also. The ferro-concrete bridge which they were building over the lines by arrangement with the County Council was well in hand, and would be opened during the half-year. Seeing that the trams would then come directly past their station, and had by agreement with the County Council to stop in front of their entrance to the station, this should mean a considerable accession of traffic to them. The very heavy works that

they had in hand at Baker Street were moving on well He was glad to be able to tell them that arrangements had now been made for the electrification by the lessee companies of the East London Railway. It was expected that this work would be carried out during the present year, and as soon as it was completed they should commence the running of a through electrical service to New Cross. When they previously worked through to this line it was a valuable feeder to their traffic, and they confidently expected that under electrical conditions the line would again do a good business. In regard to the strike amongst railway servants in August last, out of a total of 3,300 staff, 924 of their men went out. This was, of course, not a high percentage, but unfortunately the proportions were greatest among the men engaged in the actual working of the trains, such as motormen, guards, &c. They had no grievances as to pay or otherwise, and only a few days before the strike they officially expressed to the general manager their satisfaction with the conditions under which they were employed. Throughout the three days they were able to keep a fairly satisfactory service of trains running on all sections of the line. Reference was made in the report to the proposed absorption of the London General Omnibus Co. and its business by the Underground Electric Railways Co. of London. It was, of course, not known definitely at the moment whether that arrangement would be made, but in view of the possibility of its coming about they were very carefully considering how the position of this company was likely to be affected. It would not be prudent for him to say more on this subject except that they did not view the new situation that might be created with any apprehension, and they were certainly in no way hostile to it.

Lord Furness seconded the motion.

The report was adopted.

Mr. C. Pownall moved a resolution to the effect that a sum of £100 be paid as an annual subscription to the Anti-Socialist Union for the express purpose of enabling that body to carry out their proposed scheme for dealing with Socialism in the railway industry. In a long speech, Mr. Pownall contended that the railway directors were not doing their duty to the shareholders in sitting down quietly while Socialists in and out of Parliament slandered the companies by making untrue statements regarding the treatment of their employés. There were 700,000 railway shareholders in the United Kingdom, and there was a great opportunity for them to weld themselves together into a powerful body to resist the deliberate attempt now being made to deprive them of their property.

Col. Perry seconded the proposition.

The Chairman said he did not wish to rule the resolution out of order, but the solicitor had given it as his opinion that it was not possible to pass such a motion unless specific notice had previously been given. If the meeting passed the resolution, the board would have to consider whether they could give effect to it. They were thoroughly alive to the evils of Socialistic propaganda amongst railway men, and he was quite sure the public was. As to strikes, probably no men had had more experience of strikes than Lord Furness and himself during the last 30 years. They knew the difficulties of dealing with these labour questions, and they would do all they possibly could to prevent these attacks upon the property of railway shareholders. They needed no spurring up by the shareholders to induce them to do their duty. Perhaps with that expression of sympathy the mover would withdraw his resolution.

Mr. Pownall said he must press the motion, in view of the urgency of something definite being done in the matter.

On a show of hands the resolution was carried by a large majority.

Subsequently a special meeting was held, at which a resolution was passed approving of the company's Bills promoted for the ensuing session of Parliament.

Lanarkshire Tramways Co.

The directors' report for the half-year ended December 31st, 1911, states that the revenue was £40,016, and the expenses were £20,243, leaving £19,773, less contributions payable to local authorities, £2,013 ; interest on debentures, £825 ; interest account, £496 ; discount and expenses of debenture issue, £762 ; amounts written off, as per revenue account, £849 = £4,945 ; leaving £14,828, plus £7,073 brought forward = £21,901. Of this amount £9,000 has been placed to reserve for depreciation, and the directors recommend that the balance be disposed of as follows :—£11,147 to dividend at the rate of 6½ per cent. per annum for the half-year on the issued share capital ; £368 to directors, being 10 per cent. of net profits after payment of 5 per cent. dividend for the year ; £1,385 to revenue new account. The traffic receipts for the half-year show an increase of £2,250, and the expenses an increase of £310, as compared with the receipts and expenses for the corresponding half-year of 1910. The increase in receipts is mainly due to the New Stevenston extension, which was opened for public traffic on July 31st. The results of the working of this extension are satisfactory. The capital expenditure during the half-year has amounted to £17,759. The New Stevenston extension cost £10,682, and four additional cars £2,761. The payment of £3,500 for local authorities was made to the burgh of Motherwell towards the cost of building a new bridge over the Calder. The line to New Stevenston runs over the new bridge. Four £50 debentures have been allotted since July 1st last, making a total issue during the year of £14,650 in £50 debentures. The discount and expenses of the issue, aggregating £762, have been written off. The directors have transferred £9,000 to reserve for depreciation. Interest has also been credited to the reserve, making a total contribution for the year of £10,555. A dividend for the half-year at the rate of 6½ per cent. per annum is recommended, making 6 per cent. for the year. This dividend involves payments to the local authorities for the year of £2,892. The Lanark County Council has promoted a Bill to construct tramways from Uddingston to Bellshill and Mossend to connect up with the company's lines, and also to acquire the company's undertaking forthwith. It is the company's intention to oppose the Bill.

Half-year ended—	Gross profit.	Contributions to local authorities.	Int. charges. Deb.	Int. charges. Gen.	Cap. exp. written off.	Reserve for depreciation.	Dividends. Rate %	Dividends. Amount.
June, 1910	£15,582	£825	£608	£—	£—	£—	5½	£9,433
Dec., ,,	17,795	825	608	1,115	698	9,760	6	10,290
June, 1911	17,173	879	674	614	—	763	5½	9,433
Dec., ,,	19,773	2,013	825	496	849	9,792	6½	11,147

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1910	21·28	6,926,878	£35,681	1·23d.	890,689	60
Dec., ,,	21·28	7,206,852	37,297	1·24d.	907,632	60
June, 1911	21·28	7,074,121	36,002	1·22d.	885,322	60
Dec., ,,	22·80	7,757,442	39,476	1·22d.	940,607	64

Yorkshire Electric Power Co.

The directors have issued their accounts for the 12 months ending December 31st, 1911, and a report on the progress made by the company during that period. The gross profit on the revenue account for the three corresponding yearly periods ending December 31st is as follows : 1911, £12,572 ; 1910, £11,308 ; 1909, £6,087. The net profit, after payment of mortgage interest for the same periods, is : 1911, £7,784 ; 1910, £6,503 ; 1909, £2,665. The net profit of £7,784, with £9,476 brought forward from 1910 after payment of the dividend due on the cumulative preference shares up to December 31st of that year, makes a total of £17,259. After deducting the dividend paid on the preference shares up to June 30th, 1911, a balance of £16,123 remains, and the directors recommend that this amount should be disposed of as follows : To pay a dividend (less income-tax) for the half-year ending December 31st, 1911, at the rate of 6 per cent. per annum on the amount paid up on the cumulative preference shares amounting to £1,746 ; to write off administration and development expenses, £14,047 ; and to carry forward £330. The effect of the breakdown mentioned at the shareholders' meeting in September last is reflected in the accounts, which show a smaller increase of profits than was anticipated. Considerable extra expense was incurred due to the special arrangements made, and the temporary plant installed, to maintain the company's supply. The supply to customers was maintained without any serious inconvenience to them, but to secure further the reliability of the company's supply and to give a larger margin of safety, additional generating plant has been ordered. During the past year an agreement has been made with the Heckmondwike Urban District Council for a bulk supply. The company is now giving a bulk supply to the Corporations of Brighouse, Dewsbury (Ravensthorpe) and Pudsey ; and to the Urban District Councils of Mirfield and Whitwood. The company is also giving to the distribution company a supply in Calverley, Castleford, Farsley, Gomersal, Hipperholme, Horsforth, Liversedge, Ossett and Sowerby Bridge, for tramways, power and lighting purposes. The supply to the distribution company is steadily increasing, and it has now become one of the largest customers of the power company. In order to assist in its development, the power company has taken up shares in it under the powers contained in the Yorkshire Electric Power Act, 1910. In addition to considerable extensions made by customers of the company to their existing installations (which is gratifying evidence of their appreciation of the advantages of the company's supply), further important supply agreements have been made with colliery-owners, textile manufacturers, engineers and others. The increasing adoption of electricity for street lighting in all parts of the country is well marked in Yorkshire. The company's supply is now being used by the Mirfield, Horsforth and Whitwood District Councils, and an agreement has been made with the Halifax Rural District Council for a supply at Hartshead. Considerable extensions have again been made to the company's system to supply new demands, and further generating plant has been ordered to meet these new demands. Further applications for cumulative preference shares have been received, and at the date of this report £95,990 has been applied for out of the £100,000 authorised.

Smithfield Markets Electric Supply Co., Ltd.—The directors report that, for the year 1911, the gross profit amounts to £3,869, compared with £3,094, and the net profit to £1,383 compared with £446. A sum of £400 has been placed to the sinking fund for the redemption of the debenture stock, and £500 to depreciation and general reserve fund accounts. The available balance, including the amount brought in from 1910 is £1,829. The directors recommend a dividend at the rate of 2 per cent. on the ordinary shares, absorbing £1,200, carrying forward £629. The output of current shows a satisfactory increase over the previous year, and a reduction has also been effected in the costs per unit. The plant and machinery has been fully maintained out of revenue. The value of the plant taken out has been written off depreciation and general reserve fund account, which now shows a credit balance of £15,590.

Central London Railway Co.

The directors' report for the half-year ended December 31st, 1911, states that the capital expended during the half-year was £65,288. The financial results of the half-year's working are as under :—

	1911.	1910.	Inc. or dec.
Traffic receipts	£125,806	£143,433	— £17,627
Miscellaneous receipts	12,746	12,156	+ 590
Gross receipts	£138,552	£155,589	— £17,037
Less working expenses..	73,696	88,529	— 14,833
Balance to net revenue account ..	£64,856	£67,060	— £2,204

After providing for interest on the debenture stock, and other payments, the net revenue account shows that, including the amount brought forward from last half-year, there is an available balance of £83,170, as compared with £94,371 in the corresponding period. After deducting £6,136 for interest on the 4½ per cent. preference stock there remains a balance of £77,035, out of which the directors recommend the declaration of the following dividends :—On the undivided ordinary stock at the rate of 3 per cent. per annum for the half-year ; on the preferred ordinary stock at the rate of 4 per cent. per annum for the half-year ; on the deferred ordinary stock at the rate of 2 per cent. per annum for the whole year. These payments will require £50,883, leaving a balance of £26,152. The number of passengers carried for the last three years, including those using season tickets, through tickets, and the cheap return tickets issued before 7.30 a.m., is as follows :—

	June.	December.	Total.
1909	18,989,109	19,394,285	38,383,394
1910	20,664,896	19,995,960	40,660,856
1911	20,006,287	18,076,996	38,083,283

The diminished traffic receipts are due to the severe motor-'bus competition, but it is satisfactory to note that against this decrease in passenger traffic a very considerable reduction in the working expenses has been brought about as a result of economies effected, although the sums expended on maintenance and renovation are in excess of those spent during any corresponding period of the history of the railway. The construction of the Liverpool Street extension is progressing satisfactorily, and it is hoped that the line will be open for traffic about the middle of the year. The company's Bill for through running to the Ealing Broadway Station of the Great Western Railway has received the Royal Assent, and plans for the constructional work have been agreed to between both companies. During the national railway strike in August last, practically all the motor-drivers and a few men in each of the other grades deserted the company, but fortunately owing to previous arrangements this caused the railway little inconvenience. The men stated that they had no grievances of any kind, but went out in sympathy with the other strikers. In consequence of the intervention of the Board of Trade, they were subsequently reinstated. The expense involved in providing for emergencies, including the rewards given to the loyal servants, amounted to £1,756.

Mersey Railway Co.

The directors report that, for the half-year ended December 31st, 1911, the train-mileage run was 301,685 miles, as compared with 332,437 during the corresponding six months of 1910. The number of passengers conveyed has been 5,914,743, as against 6,026,032, exclusive of season ticket holders. The total receipts from all sources for the half-year have been £54,150, as compared with £55,419 for the corresponding period of 1910. The working expenses, exclusive of the charges for pumping, ventilation, and lifts, have been £27,065, equal to 49·98 per cent., as against £27,796, equal to 50·16 per cent. for the corresponding six months. These charges for pumping, ventilation and hydraulic lifts, for the past half-year, amounted to £3,125, equal to 5·77 per cent., as compared with £2,913, or at the rate of 5·26 per cent. for the corresponding period of 1910. During the months of July, August and September the receipts were adversely affected by the exceptionally hot weather and the serious labour troubles in the district, but during the remaining months they again showed a substantial increase over those of the previous year. Under the scheme of arrangement scheduled to the Mersey Railway Act, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz., 1866, 1871, 1882-3-5 and B, is contingent on the revenue of the company available therefor in each separate year. The auditors have certified that the revenue available for this purpose for the year ending December 31st, 1911, amounts to £13,644, which is accordingly being distributed to the debenture-holders as follows : Interest at 4 per cent. on the 1866 debenture stock, £4,664 ; interest at 3 per cent. on the 1871 debenture stock, £2,999 ; interest at £1 13s. 2½d. per cent. on the 1882-3-5 debenture stock, £5,978 ; balance carried forward, £3. The interest on these debenture stocks was duly paid to the debenture-holders on January 29th, 1912.

St. James' and Pall Mall Electric Light Co., Ltd.

The directors' report for the year ending December 31st, 1911, states that supply has been distributed on a total connection of 13,975 kw., being an increase of 976 kw. For this purpose 10,708,689 units were supplied to consumers. The Central Electric Supply Co. has declared a dividend of 5 per cent. on the ordinary shares, in respect of which £2,500 will, in due course, be payable to the company. The new equipment of the Mason's Yard Works as a transformer sub-station for the high pressure supply derived from the Central Electric Supply Co. has now been completed, and a large battery of accumulators has been added to form an efficient reserve. The results hereby obtained are most satisfactory and promise further improvement. The directors have therefore decided to re-equip part of the Carnaby Street works on the same lines. In view of the obsolescence of plant which will be superseded by this re-equipment an extra amount has been written off for depreciation during the year under review, and the directors have carried a sum of £4,500 from net revenue account to the credit of contingency fund. The net profits for the year 1911 applicable to dividends on shares amount to £27,178, plus £2,116 brought forward ; less interim dividend paid in August last for half-year ending June 30th, at the rate of 7 per cent. on preference shares, £3,500 ; 10 cent. on ordinary shares, £10,000 ; leaving £15,794 to be dealt with. The directors propose to pay a dividend at the rate of 7 per cent. on the preference shares for the second half-year, £3,500 : to pay a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid in August last, a total distribution of 10 per cent. for the year, £10,000 ; carrying forward £2,294. The directors regret the loss by death of their esteemed colleague, Colonel Eustace Balfour, who was for 20 years chairman of the company. The Rt. Hon. Gerald William Balfour has been elected a director during the year. Mr. Balfour previously held a seat on the board, which he resigned in 1895 on his appointment as Chief Secretary for Ireland.

Units generated and purchased	12,925,053
Quantity utilised—Private supply	10,708,689
Used on works	403,531
Total	11,112,220
Quantity expended in distribution	1,812,833
Total connections in kw. Dec. 31st, 1911	13,975

The Russian A.E.G. Co.—The close association of German banking interests with Russian undertakings is again illustrated by the fact that the total ordinary share capital and bonds of the Russian A.E.G. Co. have just been admitted to the Berlin Stock Exchange on the proposal of the Dresden Bank, the Darmstadt Bank, the banking firm of S. Bleichroder, the Disconto Gesellschaft, and the National Bank for Germany. As indicated by its title, the Russian company is connected with the Berlin A.E.G., although the Berlin Handels Gesellschaft, which is one of the banking associations of the A.E.G., does not appear to be directly interested in the present transaction. The prospectus, which notifies the admission of the whole of the 32,000 shares of 250 roubles, or 8,000,000 roubles, and of 5 per cent. bonds of 1,768,500 roubles, states that the shares are offered for subscription at 135 per cent. plus 4 per cent. interest from January 1st, 1911, and the bonds at 97 per cent. plus 5 per cent. interest from January 1st, 1912. It is, therefore, intended that a market for the company's entire capital should be created in Germany, although it is not stated where the capital has hitherto been held. The company, which was formed in 1901, with a share capital of 1,000,000 roubles, acquired the assets and liabilities of another undertaking in 1902, and the largest portion of the assets of the Russian Union Co. in 1905. These and other operations have raised the share capital to its present total, whilst the bonds were issued in 1905. The company has manufacturing works in Riga, where 1,360 workers are employed, possesses installation departments in St. Petersburg, Moscow, Warsaw, Odessa, and several other towns, and holds one-third of the shares in the United Cable Works Co., of St. Petersburg, which was formed in 1906 in association with the Russian Siemens & Halske Co. and the Felten & Guilleaume Co. The dividends paid for 1909 and 1910 were 6 per cent. and 7 per cent. respectively, on a share capital of 7,000,000 roubles.

Stock Exchange Notices.—The Committee have appointed a special settling day as under :—

Wednesday, February 21st.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each (issued at £1 premium), £1 paid (of which 5s. is capital and 15s. premium), Nos. 750,001 to 1,000,000.

And ordered the undermentioned securities to be quoted in the Official List :—

Melbourne Electric Supply Co., Ltd.—Further issue of 10,000 7 per cent. first cumulative preference shares of £5 each, fully paid (Nos. 50,001 to 60,000).

South London Electric Supply Corporation, Ltd.—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1911 at the rate of 5 per cent. per annum. For 1910 the dividend was at the same rate.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register will be closed from 15th to 28th inst. (both days inclusive) for the preparation of warrants for dividends payable 28th inst.

Western Electric Co. (U.S.A.).—According to a report in the *Times*, the American Telephone and Telegraph Co. has purchased 5,000 shares of $100 par value of the Western Electric Co. at 225. "This increases the Telephone Co.'s holdings of this stock to 125,000 shares out of 150,000, and it is expected that it will soon make an offer for the remainder of the minority stock."

Bank Rate.—The Bank Rate was yesterday reduced from 4 to 3½ per cent.

STOCKS AND SHARES

Tuesday Evening.

In spite of the fact that the Bank Rate still remains high for this time of the year, Stock Exchange markets are in the main steady, and there is a good deal of business going on in one part and

another. So far as speculation is concerned, activity centres round a few small groups, in which dealings are fast and furious. One of these, of course, is the Marconi market, and another is that section affected by the Metropolitan transport arrangements. Investment shook its head disappointedly over the absence of anything in the speech of Mr. Lloyd George last Saturday from which comfort might be derived by the holders of Consols. Home Railway stocks, however, have for the time being shaken off their allegiance to the Funds, and are moving on their own axis, of which the labour problems constitute the hub.

Of the Electric Railway stocks, the Central London trio is the chief feature this week. Both Ordinary and Deferred stocks jumped 4, and the Preferred put on a point in anticipation of the opening of the Liverpool Street extension this summer. Moreover, it is being pointed out that the traffic will be fed from the East London Railway; and, in consequence of this, East Londons rose ⅛ to 7⅞. Central Londons have not moved to any extent for so long a time that a rise was overdue. City and South London, *ex* dividend, is practically unchanged, but Great Northern and City Preferred recovered their fall of 7s. 6d. which occurred last week, London United Tramways Preference putting on 5s., while the Debenture stock rose 2. A rise of ¾ in Metropolitan Ordinary carried the price to 47¾, and the Surplus Lands stock at 69 is again a point higher. Districts firmed up to 35. In the Underground Electric Railways issues there is a fair amount of activity. The dividend announcement, making 2 per cent. on the Income Bonds for the year, did not come up to general expectations, but there is little change in the price of the bonds. Considerable gambling is going on in the shares that are to be created in the carving up of the London General Omnibus Company by the Underground Electric, and these "Fusion" shares, as they are called, which are to be of the nominal value of 1s. each, are being dealt in on the basis of 6s. 6d. for special settlement.

These rises have drawn attention to the newly-quoted British Electric Traction issues, the price of which appeared here last week. The Deferred rose to 7½, and the 6 per cent. Preferred at 88 is 2½ higher, while the First Debenture hardened. There has also been a little inquiry for Potteries Ordinary, and at 8s. 9d. the price shows $\frac{1}{16}$ rise.

In the list of English Electricity Supply shares, the buying movement manifests itself in advances that have occurred in some half-dozen cases. Improvements of ¼ are shown by Bournemouth and Poole Ordinary and Westminster Ordinary, while Edmundson's and Urban Preference gained 7s. 6d.; and smaller rises are registered by Chelsea Ordinary and St. James' Ordinary. The improvement in Westminsters underlines the opinion expressed here last week that the shares at their then price were undeniably cheap. Edmundson's Debenture moved up along with the Preference, and is 4 points higher. There is a good deal of pleasure in noting these steady improvements, for the market has been too long neglected, and the better-class shares got down too low.

Telegraphs and Telephones have been animated, though most of the interest revolved round a few specialities. Of these, Marconi's continue to take first place, and once more substantial rises were secured by the Ordinary and Preference shares, although the Ordinary gave way later on. A statement as to the agreement between the British Government and the Marconi Company is imminent. West India and Panama Telegraphs, after being 5¼ buyers, slipped back to 4⅞ upon appreciation of the view expressed that £5 a share discounts a good deal of what may be expected to happen by reason of the opening of the Panama Canal. Moving with Panamas, West Coast of America fell back ⅜ after their jump of ⅝ last week. Amazon Telegraphs are ¼ better. The Anglo-American Telegraph group, marked *ex* dividend last Wednesday, shows practically no change, allowing for the deductions; while the Eastern group continues steady, without attracting any particular attention. National Telephones are a rather better market, the Deferred recovering 1½, but dealings in the stocks are now comparatively few. Reuters shares at 9⅜ are ⅜ better, for which the approach of the dividend time is responsible.

The market in Colonial and foreign electricity issues is a trifle erratic, but the changes do not amount to much in either direction. British Columbia Electric Railway stocks are a better market, the Deferred and Preferred both showing rises. Rio Trams and Mexico Trams are easier, although the bonds of each company have improved slightly. Shawinigan Water is another example in which the capital stock shows a small loss, counter-balanced by a rise in the First Mortgage bonds. Anglo-Argentine Tramways are still being absorbed by the investor, and the prices of the two junior Debenture stocks, with the First Preference, have responded to the demand. Brisbanes are easier, and Calcutta Trams lost ¼. On the other hand, Capes continue to improve. The new issues promised in this department are slow in making their appearance, but are probably being held back by the comparative stringency in the money market.

Manufacturing descriptions are very quiet. The feature is an improvement of ⅛ in Willans & Robinson Preference, following upon the rise of 10s. last week. The Debenture stock is nominally 3½ points down, although the market in it is so narrow that the precise fall is not so severe as this. British Insulated Preferences at 6, *ex* dividend, have regained the amount deducted when the price was so marked. Castner-Kellner Debenture is also *ex* dividend, and has recovered the full amount of 2¼ taken off. The recent activity in Rubber shares continues to fade away, and business has once more dwindled to a material extent. Mincing Lane authorities look for a further advance in the price of the raw stuff, but their prophecies have not always been correct in the past, and speculators in Rubber shares are not inclined to trust the share market very far.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Jan. 31	2,681	+ 253	35	52,958	+ 3,145	14·4	..
Ayr	Feb. 3	352	— 2	38	11,978	+ 136	8	..
Bath	Jan. 31	1,237	— 22	5	3,364	+ 127	14·75	..
Birkenhead	Feb. 4	2,141	+ 112	44	50,701	+ 1,886	13·68	..
Birmingham Corp.	Jan. 27	20,120	+6,329	43	380,651	+81,778	56·4	..
Blackburn	„ 31	1,864	+ 39	44⅓	51,441	+ 4,162	14·6	..
Blackpool Corp.	Feb 1	886	+ 58	..	60,785	+ 7,891	11·87	..
Blackpool-Fleetw'd	„ 8	515	+ 20	4	1,244	+ 39	8	..
†Bolton	Dec. 2	2,412	+ 172	36	90,575	+ 6,040	26	..
Bournemouth	Jan. 31	2,760	+ 230	44	78,938	+ 595	21·95	..
Bradford	„ 27	10,109	+ 591	43	236,514	+14,795	56	1·2
Brighton	Feb. 4	1,402	— 14	44⅔	45,875	+ 2,501	9·5	..
Bristol	„ 2	11,164	+ 433	5	80,063	+ 2,508	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	Jan. 26	517	+ 101	4	1,053	+ 232	3·65	..
Barnsley	„ 26	971	+ 40	„	669	+ 73	..	..
Barrow	„ 26	794	+ 156	„	1,029	+ 287	5·37	..
Devonport	„ 26	977	+ 162	„	1,879	+ 284	8·85	..
Gateshead	„ 26	1,985	+ 51	„	3,761	+ 119	11·25	..
Gravesend	„ 26	392	+ 52	„	738	+ 92	6·5	..
Greenock	„ 26	1,806	+ 144	„	2,443	+ 284	7·25	..
Hartlepool	„ 26	463	+ 56	„	879	+ 118	6·72	..
Kidderminster	„ 26	172	+ 16	„	320	+ 23	..	..
‡Leamington	„ 26	379	+ 23	„	520	+ 33	..	..
Merthyr	„ 26	377	+ 23	„	708	+ 54	2·9	..
Metropolitan	„ 26	16,287	+1,616	„	30,451	+ 3,027	22	..
Middleton	„ 26	518	— 15	„	992	— 18	8·5	..
Mid. Joint Com'tee	„ 26	5,399	— 235	„	10,379	+ 25	..	..
Oldham—Ashton	„ 26	1,069	+ 59	„	2,003	+ 124	9·13	..
Peterborough	„ 26	218	+ 30	„	407	+ 56	5·31	..
Potteries	„ 26	3,788	+ 15	„	7,182	+ 240	29	..
Rothesay	„ 26	81	+ 6	„	215	+ 37	2·75	..
Southport	„ 26	433	— 9	„	863	+ 14	8·17	..
S. Metropolitan	„ 26	1,389	+ 28	„	2,595	+ 106	..	..
Swansea	„ 26	2,108	— 77	„	4,018	+ 83	12·5	..
Tynemouth	„ 26	253	— 25	„	505	— 38	3·75	..
Weston-s-Mare	„ 26	46	+ 18	„	98	+ 38	3	..
†Worcester	„ 26	457	+ 7	„	893	+ 24	5·75	..
Wrexham	„ 26	177	— 2	„	339	+ 16	..	..
Yorks. Wool. Dist.	„ 26	2,009	+ 71	„	3,869	+ 170	17	..
Miscellaneous	„ 26	390	+ 18	„	733	+ 37	..	..
Burnley	Feb. 3	2,392	— 137	..	..	..	11·73	..
Burton-on-Trent	„ 4	486	+ 32	44	12,743	+ 671	6·6	..
Bury	„ 3	2,113	— 17	44⅔	56,489	+ 4,885	29·5	..
Cardiff	„ 3	4,251	+ 130	44	108,188	+ 7,874	17·35	..
Chatham and Dist.	Jan. 25	1,515	+ 44	4	2,809	— 21	14·9e	..
Cork	Feb. 1	797	— 17	5	1,973	+ 13	9·89	..
†Croydon	Jan. 19	1,580	+ 104	42	76,026	+ 5,208	11·64	..
Darlington	Feb. 3	411	+ 29	45	9,954	+ 927	4·87	..
Darwen	„ 3	441	— 2	44	11,802	+ 804	4·36	..
Dover	Jan. 27	370	+ 31	43	11,066	+ 1,469	4·75	..
Dublin	Feb. 3	10,021	+ 213	5	25,040	+ 1,366	54·25	..
Dundee	Dec. 22	2,212	+ 87	27	82,513	— 760	15	..
East Ham	Feb. 3	1,593	+ 148	44	48,666	+ 2,836	7·87	..
Exeter	„ 2	457	+ 2	44	15,032	+ 967	5·5	..
Glasgow	„ 3	33,774	— 238	33	671,347	+57,641	98	..
Hastings	„ 1	1,323	— 27	..	..	+ 186	19·3	..
Huddersfield	„ 3	3,437	+ 32	44	84,628	+ 7,593	28·6	..
Hull	„ 3	5,604	+ 343	44	130,011	+ 7,230	14·5	..
Ilkeston	„ 1	231	+ 11	44	5,793	+ 164	3·8	..
Ipswich	„ 3	633	— 1	44	19,540	+ 1,014	10·5	..
Kilmarnock	Jan. 27	236	+ 3	37	6,123	+ 445	4·25	..
Lancashire United	„ 31	2,325	— 42	5	5,432	— 18	39	..
Leeds	„ 27	14,147	+ 764	43	326,214	+22,007	57·5	..
Leicester	Feb. 3	4,770	+ 342	..	..	..	20	..
Leith	„ 3	1,108	+ 35	37⅔	24,633	+ 1,895	8·72	..
Liverpool	Jan. 27	22,249	+1,122	39	45,611	+ 3,165	116	..
†L.C.C.	„ 24	84,988	+5,157	42	1,887,449	+96,898	138·4	6
London United	Feb. 3	9,875	— 50	5	25,624	+ 592	..	..
Lowestoft	„ 3	254	— 21	18	3,015	+ 24	3·5	..
Manchester	„ 3	29,913	+ 296	44	717,258	+36,122	105	..
Newcastle	„ 3	7,984	+ 223	..	189,868	+14,576	31·3	..
†Newport	Jan. 27	631	— 10	43	30,644	+ 1,057	7·25	..
Oldham	Feb. 4	3,344	— 131	45	86,980	+ 3,788	23	..
Pontypridd	„ 3	745	— 46	44	18,855	+ 10	5·5	..
Portsmouth	Jan. 27	3,815	+ 191	43	95,764	+ 6,960	15·25	..
Preston	„ 31	1,295	+ 5	44	34,532	+ 2,169	10	..
Rotherham	Feb. 1	1,807	+ 73	43⅔	30,478	+ 2,446	12	..
Salford	Jan. 29	8,903	+ 13	43⅔	212,347	+ 9,024	41	..
Sheffield	Feb. 6	12,697	+ 640	44⅓	292,747	+18,621	40	..
Southampton	Jan. 31	2,151	+ 218	44	54,580	+ 6,234	11	..
Southend-on-Sea	„ 31	850	+ 120	44	30,202	+ 4,611	7	..
South Shields	Feb. 3	1,073	+ 42	44	27,687	+ 2,929	10·25	..
Swindon	Jan. 31	285	+ 42	..	7,121	+ 808	3·7	..
Tyneside	„ 31	814	+ 56	5	1,985	+ 137	11	..
Wallasey	„ 27	1,880	+ 177	43⅔	47,841	+ 6,211	8·72	..
Walthamstow	Feb. 3	1,219	+ 95	44	33,007	+ 1,900	9	..
West Ham	Jan. 25	5,264	+ 703	43	117,683	+10,462	15·25	..
Wolverhampton	„ 31	1,689	— 62	44	43,452	+ 2,025	25	..
Cen. London Rly.	Feb. 3	10,346	— 415	5	25,821	— 1,747	6·32	..
City & S. Lon. Rly.	„ 4	6 885	— 48	5	17,284	— 561	7·26	..
Dublin-Lucan Rly.	„ 3	220	+ 12	5	518	+ 15	7	..
G.N. and City Rly.	„ 3	3 483	+ 232	5	8,594	+ 544	3·5	..
L'pool Overh'd Rly.	„ 4	3,081	+ 228	5	7,449	+ 548	6·5	..
Llandudno-Col. Bay	„ 2	237	+ 18	9·5	1,240	+ 143	6·6	..
Lond. Elec. Ry. Co.	„ 3	29,960	+1,960	5	75,545	+ 3,610	21·25	..
Mersey Railway	„ 3	4,139	+ 132	5	10,581	+ 263	4·5	..
Metropolitan Rly.	„ 4	34,185	+ 333	5	83,980	+ 866	25·75	..
Met. District Rly.	„ 3	25,199	+1,590	5	63,252	+ 3,348	25	..
Anglo-Argentine	„ 4	100,674	+5,779	5	251,218	+ 8,358	..	..
‡Auckland	Jan. 19	19,830	+1,761	6⅓	119,299	+ 9,314	23·3	..
Bombay (B.E.T.)	„ 5	6,090	+ 575	..	..	..	..	..
‡Brisbane	Dec.	24,230	+3,105	52	252,100	+30,555	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Feb. 3	7,729	+ 589	..	..	+ 3,959	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A.	Dec.	3,589	..	..	41,383	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	Jan. 31	1,608	+ 106	4	3,178	+ 4	..	..
§Montevideo	Jan.	25.051	+3,106	3	90,768	+ 8,053	..	..
Perth (W.A.)	Feb. 2	3,962	+ 553	5	9,417	+ 1,368	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	8 — 9	+ ½	6 2 3
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	9†	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3¾ — 4½	+ ⅛	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4½	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4⅛ — 4⅜	+ ⅛	5 8 1
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	6†	13⅜ — 13⅝	..	5 2 9
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 13 4
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	4†	9⅛ — 9⅝	..	5 8 11
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2½ — 3	+ ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 90	+4	5 0 0
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	92 — 95 xd	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	.	1⅜ — 1⅞	..	3 12 0
Do. 6 % Pref.	5	6	6	4⅝ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	5	4†	3⅝ — 4¼	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	95 — 97	..	4 12 9
Newcastle-on-Tyne	5	4	4†	3¾ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	9½ — 10½	..	..
Oxford	5	7½	6†	6¼ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8¼ — 8⅝	+ ⅛	5 16 0
Do. 7 % Pref.	5	7	7	6½ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅝ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 10 11
Urban, Ord.	5	5	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 2⅝	+ ⅛	..
Do. 4½ % First Mort. Deb.	100	4½	..	88 — 90	..	5 0 0
Westminster, Ord.	5	10	10†	8¾ — 8⅞	+ ¼	5 16 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 6	+ ¼	5 0 0
Calcutta, Ord.	5	8½	7†	6½ — 6⅝	..	6 6 0
Do. 5 % Pref.	5	5	5	4½ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	93 — 95	— ½	5 5 8
Canadian Gen. El. Com.	$100	7	7†	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	117 —121	..	5 15 8
Cordoba Lt., Power and T., Ord.	1	3	3†	¾ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ — 94½	+ ½	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	7/8 — 15/16	..	7 7 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —103	..	4 17 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86¼ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4†	87½ — 89½	..	4 9 5
Do. 7 % Cum. Pref.	$100	7	7	107½ —109½	..	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97 xd	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	+ ½	5 9 8
Montreal, Lt., H. and Power	$100	7	8	198 —198 xd	—2	3 9 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 2 10
River Plate, Ord.	Stock	10	..	250 —260	..	3 16 11
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —113	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	100½ — 102½	..	4 17 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	5†	128 —130	—1	3 16 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	+1	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ — 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¼d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ — 108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7¾	+ ¼	..
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	141½ — 143½	— ½	5 11 6
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3¾	3†	65¾ — 67½ xd	..	4 8 11
Do. 6 % Pref.	Do.	6	6	109½ — 110½ xd	..	5 8 4
Do. Def.	Do.	30/-	30/-	25⅝ — 25¾ xd	..	5 15 11
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101⅓ — 103⅓	..	4 16 7
Chili Telephone	5	7	..	7¼ — 7⅝	..	4 13 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	10¼ — 11¼	..	5 6 8
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	98½ — 100⅝	..	4 9 7
Direct United States Cable	10	4½	..	7⅜ — 9⅛ xd	..	5 10 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	+ ⅛	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	88 — 85	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	100 —102	..	3 18 5
Eastern Extension	10	7	5†	13¼ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10⅜ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 0
Great Northern Telegraph	10	18	5†	32 — 33	..	5 9 1
Indo-European Telegraph	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common	$100	5	5†	77 — 80	..	6 5 0
Do. 4 % Cum. Pref.	$100	4	4	70 — 72	—1½	5 11 1
Marconi's Wireless Telegraph	1	5	..	4 — 4¼	— 1/16	..
Do. *7 % Cum. Partic. Pref.	1	18	..	3 3/16 — 3 5/16	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1¾	..	12 11
Do. 5 % Pref.	1	5	5	1⅜ — 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	90½ — 102½	+ ½	5 17 1
Do. Def.	Do.	6	6†	122½ — 124½	+1½	4 16 5
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	..	4 9 11
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ — 103½	..	4 7 0
Oriental Telep. and Elec.	1	8	..	1⅜ — 1⅝	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 18 8
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	+ ½	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98½ — 100½	..	3 19 7
Reuter's	8	5	5†	9½ — 9¾	+ ⅜	4 3 8
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98½ — 100½	+ ½	4 9 7
United River Plate Telephone	5	8	8	7⅞ — 7⅞	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1½ — 1⅝	— ⅛	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98½ — 100½	..	3 19 7
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4⅜	— 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅝ — 11½	+ ⅛	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅝	— ⅛	5 15 8
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	6†	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	7/8 — 15/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	14 — 18	..	..
Do. Do. Deferred	100	..	..	6 — 9	+1	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	87 — 89	+2½	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 41	..	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	+1	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3†	72 — 74	+4	4 1 1
Do. Pref.	100	4	4	85 — 87	+1	4 12 0
Do. Def.	100	2	..	62 — 64	+4	3 2 6
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1½	1½†	28 — 29 xd	..	5 12 1
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	101 —103 xd	..	4 17 1
Do. Do. 1903	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1/8 — 1/4	+ 1/8	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	1/2 — 3/4	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2½	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	80 — 82	+1	6 2 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅜ — 4½	+ 1/4	..
Do. 4 % Deb.	100	4	4	77 — 80	+2	5 0 0

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅜	1⅞†	47½ — 48	+ 3/4	3 18 2
Do. Surplus Lands	100	2⅜	2⅜†	68 — 70	+1	3 18 7
Do. 3½ % Deb.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	..	4 0 6
Metropolitan District Ord.	100	Nil	..	34⅜ — 35½	+ 1/4	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3¾	4¼†	91 — 93	..	3 10 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77 xd	+ 3/4	4 10 11
Metropolitan Elec. Trams, Ord.	1	5½	5†	3/4 — 3/4	..	5 13 6
Do. Def.	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	29/32 — 31/32 xd	..	5 10 2
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½—102½	..	4 17 7
Potteries, Ord.	1	2	..	1/32 — 3/32	+ 1/16	..
Do. 5 % Pref.	1	5	5	15/32 — 23/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	90 — 93	..	4 16 9
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	2⅛ — 2⅜	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	78 — 80	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2¼ — 3½	..	Nil
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅜ — 5⅝	+ 1/16	5 2 4
Do. 2nd Pref.	5	5	5⅜	4 13/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	94 — 96½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	+ ⅛	4 7 5
Do. 5 % Deb.	100	5	5	102 —104	+ ⅛	4 16 7
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝— 11⅛ xd	..	5 7 10
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	8¼— 8⅜	— 1/8	4 11 5
Do. 5 % Pref.	5	5	5	4⅛— 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	—1	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	136 —141	+1	5 13 0
Do. Pref. Ord.	100	6	6	118 —122 xd	+2	4 18 4
Do. 5 % Pref.	100	5	5	107½—110⅝	..	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	..	4 7 5
Calcutta Trams, Ord.	5	6	..	5⅛— 5⅜	— 1/8	5 4 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	12/32 — 26/32	+ 1/32	..
City Buenos Aires Trams (1904)	5	5	5	5⅝— 5¾	..	Nil
Do. 4 % Deb.	100	5	5	95 — 98	..	4 5 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	5 2 0
Kalgoorlie Elec. Trams	1	Nil	..	7/8 — 15/16	..	4 17 1
Do. 5 % A Deb.	100	5	5	91 — 94	..	Nil
Do. 6 % B Deb.	100	5	6†	58 — 62	..	5 6 5
						8 1 4

La Plata Elec. Trms, Ord.	1	..	..	11/16 — 13/16	..	..
Do. Pref.	1	6	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5⅞	6†	1 — 1¼	..	4 8 6
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93½— 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	100	5	5	93½— 96½	..	5 3 8
Manaos Trams & Lt., 1st Deb.	100	5	5	91½— 93½	..	5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	101 —103	..	4 17 1
Mexico Trams Com.	$100	7	7†	122 —124	—1	5 13 0
Do. Gen. Con. 5 % Bonds	..	5	5	101 —103	+1	4 17 1
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 3/16 — 7 1/4	..	6 10 1
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 3/16 — 1¼	..	1 15 7
Do. 5 % 1st. Deb.	100	5	5	99 —101	..	4 19 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝— 5¾	..	5 2 2
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	115 —116	—1	4 6 2
Do. 1st Mort. 5 % Bonds	..	5	5	101¼—102½	+ ¼	4 17 10
Do. 5 % Mort. Bonds	100	5	5	97½ — 98½	+ ¼	5 1 6
Sao Paulo Tram, Lt. and P.	$100	10	10†	197 —199	+1	5 0 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95 xd	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5 — 5½	..	5 9 1
Do. 6 % Pref.	5	6	6	5⅛— 5⅜	+ 1/8	5 11 7
Do. 5 % 1st Deb.	100	5	5	98½—101½	..	4 18 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	29/32 — 31/32	..	7 2 2
Babcock & Wilcox	1	26	24†	6½ — 6⅝	..	4 0 0
Do. Pref.	1	6	6	1 3/16 — 1 5/16	..	3 13 10
B.I. & Helsby Cables	5	10	8†	6⅝ — 7⅛	..	7 0 4
Do. Pref.	5	6	6	5½ — 6½ xd	+ ⅛	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	8	Nil	..	5/8 — 9/16	+ 1/16	Nil
Do. Deb.	100	4	4	55 — 58	+ 1	6 17 11
Do. 6 % Prior Lien	100	6	6	101 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9 — 9⅜	..	7 13 10
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	98 —100	..	4 10 0
Castner-Kellner	1	17½	20	8 1/16 — 8 1/8	..	4 11 10
Do. Deb.	100	4½	4½	106 —110 xd	+2½	4 1 10
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	58 — 62	..	7 7 1

Dick, Kerr	1	5	..	27/32 — 31/32	..	5 3 1
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 12 11
Do. Deb.	100	4½	4½	92½ — 95½	..	4 14 3
Edison & Swan, A, £3 paid	5	Nil	..	3/4 — 1	..	Nil
Do. fully paid	5	Nil	..	1/2 — 2/3	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	3/4 — 1	+ 1/8	..
Do. Pref.	2	7	7	1 5/8 — 1 7/8 xd	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅜ — 12½	..	6 2 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	10 — 12	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	35 — 37	..	6 7 2
Do. Deb.	100	4	4	99½—101½	..	3 18 10
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	3/4 — 1⅜	+ ⅛	Nil
Do. Deb.	100	4	4	52 — 57	+3½	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

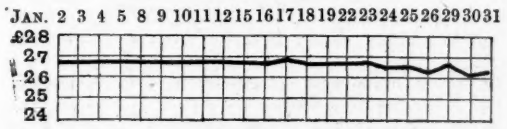
The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

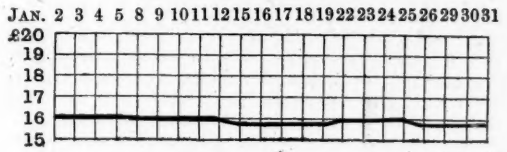
METAL MARKET.

Fluctuations in January.

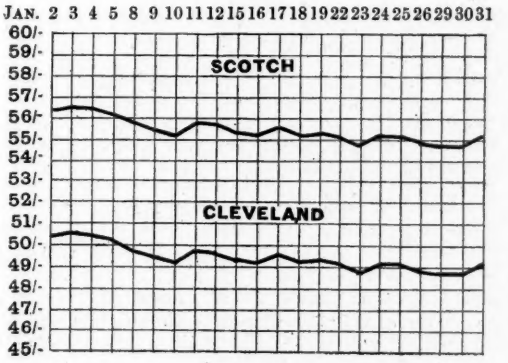
SPELTER (G.O.B's.).



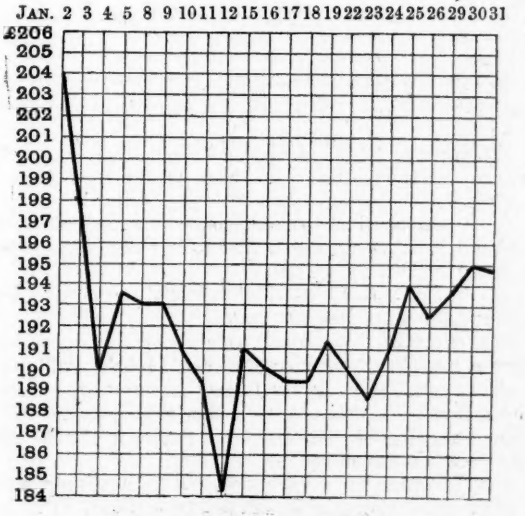
LEAD (ENGLISH).



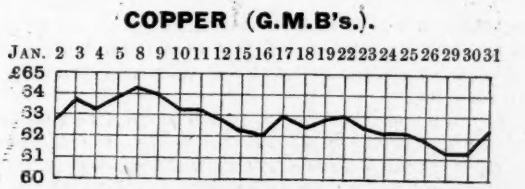
IRON.



TIN.



COPPER (G.M.B's.).



Ebonite.—Messrs. Carson & Evans, of Fenchurch Buildings, E.C., who make a speciality of vulcanite and ebonite turned and moulded work to clients' own drawings, patterns, &c., have recently supplied these goods to some of the largest firms in this country.

CONSTRUCTION AND CHARACTERISTICS OF THE NEON LAMP.

The extraordinary inefficiency of all lamps depending upon high temperature incandescence has been realised for a number of years. The cause of this inefficiency is the high percentage of the total radiations which occur outside the visible spectrum, and, though certain progress has been made in increasing the luminous radiations by raising the working temperature of the incandescent source (thereby also increasing the heat radiations), really high luminous efficiencies can only be attained by the evolution of a "cold light," *i.e.*, by reducing the heat radiations. Such a "cold" lamp is specially desirable since the high specific brilliancy of incandescent filaments and the like compels the use of diffusing media which absorb from 20 to 40 per cent. of the incident light, thus sacrificing much of the gain in efficiency resulting from high incandescence.

A Geissler tube, as ordinarily used, is a cold source, but were it possible to concentrate within the tube a discharge comparable in total candle-power with the lamps now in commercial use, it would be found that the lamp was extremely hot. The results obtained by Moore in this direction are too well known to call for detailed mention. No extraordinary efficiencies have been attained by Moore lamps, and the differences between lamps filled with various gases are quite compatible without theories concerning the mechanism of the electrical incandescence of gases.

Though there is no known gas yielding pure yellow rays under the influence of an electric discharge, there are reasonable approximations to this ideal to be found among the rare gases of the atmosphere. In the course of separating atmospheric gases for industrial purposes, M. Claude* uses apparatus yielding 50 cb. m. of oxygen per hour, and over 100 litres of neon per day. The latter amount, though apparently insignificant, suffices for the filling of 1,000 neon tubes each of 1,000 c.p., so that the rarity of the gas need form no obstacle to the commercial use of neon lamps.

The spectrum of neon is one of rare beauty, comprising a number of brilliant red and yellow bands and three fine green lines; the absence of blue rays is regrettable, but the concentration of the radiations in the region of the spectrum most affecting our eyes makes for high luminous efficiency.

Bouty has shown the extraordinarily low dielectric cohesion of neon. Thus, if 1,000 volts breaks down a certain layer of air, 40 volts suffices for the same thickness of helium and 13 volts for the same thickness of neon.

There are considerable difficulties in the way of using neon in Geissler tubes. Though the neon originally introduced be specially pure, gases occluded by the glass and the electrodes (particularly if nitrogen or hydrogen) and liberated by the passage of current, completely destroy the incandescence of the neon after a few seconds' working. It is therefore necessary to "form" the tubes at the works by absorbing all gases other than neon and helium by wood charcoal placed in a side tube plunged in liquid air, meanwhile aiding the emission of occluded gases by intermittent electric discharges. This "forming" process occupies several hours.

Despite the chemical inertness of neon, the gas is absorbed by disintegration of the electrodes so readily that the effective life of the first tubes built was from five to six hours. The degree of purity required in the neon precludes the use of any such "breathing" valve as is used in the Moore lamp, but, by fitting very large electrodes, the life of a 5-m. neon tube has been extended to 1,000 hours. Longer tubes prove yet more durable.

At present, neon tubes must be supplied with high-tension alternating current, but it is hoped to adapt short tubes to direct-current operation. A 2-kw. transformer, delivering a steady pressure of 3,200 volts, will light up three 6-m. neon tubes in series, whereas a single 6-m. nitrogen Moore tube would require over 3,000 volts.

There is a pressure drop of about 150 volts at each electrode of a neon tube; this is relatively more serious in short than in long tubes. The pressure drop in the gas column is about 80-100 volts per m. Whatever its length, a 45-mm. neon tube takes about 1 ampere current. By aid of series inductance, the current consumption can be varied from 0·6 to 1·3 amperes, with little variation in terminal p.d. and little loss of efficiency. This property is interesting and valuable. As the current is reduced, the light becomes redder in hue.

A 6-m. neon tube (5 m. useful length) yields about 900 c.p., *i.e.*, 200 c.p. per metre, as against 50 c.p. per m. in the Moore lamp. Allowing for the power factor of the lamp (0·8, due to deformation of the current wave), the efficiency of the tube is 0·72 watt per c.p. or, taking into account the transformer and inductance losses, 0·9 watt per c.p. The actual luminous column dissipates 500 × 0·8 watts, *i.e.*, works at about 0·45 watt per c.p., and very long tubes approach this limiting efficiency. Where neon tubes can be connected directly to high-tension lines, not only is the overall efficiency increased but also the cost of installation of the lighting equipment is greatly reduced.

The above efficiencies are not at all striking as compared with the efficiencies of 0·15 watt per c.p. and 0·25 watt per c.p. claimed for flame and quartz-mercury arcs respectively. It must be remembered, however, that the neon figures are of necessity results which can be equalled in everyday working, whereas the others are taken under specially favourable conditions, and are, in fact, "snatch" readings. The *practical* efficiencies of flame arcs and silica mercury lamps are more nearly 0·3 watt per c.p., and 0·4 watt per c.p. The neon figures refer to spherical candle-power, and are not subject to the 20-40 per cent. absorption loss

* *Bulletin* de la Soc. Internationale des Electriciens, November 1911.

occasioned by arc lamp globes. With 1·0-1·2 watt per C.P. metallic-filament lamps daily replacing arcs on account of their low maintenance costs, convenience, and low candle-power per lamp, it is only reasonable to suppose that neon tubes will prove formidable competitors to arc lamps of all descriptions.

The neon lamp is easily transported and erected in its finished state; it requires no attention of any sort, and its efficiency is practically constant during its life; diffusion is excellent, and though the light is useless for colour matching (blue being entirely absent), it gives excellent results in exterior and architectural illumination, and is much preferable, in indoor service, to the greenish hue of the mercury light. A luxurious rose-coloured light is given by neon tubes in conjunction with metallic-filament lamps, and by placing a 600-800-C.P. mercury lamp at the centre of a rectangular neon tube (4 × 2·5 m.), both being placed at a reasonable height, almost perfect mutual colour correction is obtained. Attempts to correct the mercury light by the introduction of neon into the tube have so far failed by reason of the impossibility of making both gases vibrate simultaneously to the desired extent.

Visual acuity is remarkably keen under neon light, and Broca and Sulzer state that the latter has distinct physiological value; reports of mental or moral injury caused by red light may be regarded as puerile. The utility of the new lamp is by no means confined to special cases, or to those in which economy is specially desirable, and the Paz and Silva firm have already carried out a number of interesting installations in various parts of France.

ELECTRIC POWER FOR THE PANAMA CANAL.—III.

By JOHN GEO. LEIGH.

Not a few of the upper, or filling, valves for the main culverts, which are being installed in the side walls of the various locks of the Panama Canal, will be required to operate under a head of about 60 ft., and to remain tight under a head of at least 80 ft. Consequently, great strength in the various parts has been demanded, resulting in a weight, per valve, of the moving nickel-steel parts alone, of 10·05 tons. The maximum water pressure on each valve is 314 tons, at rest, and, in the case of the lower valves, the operating pressure may reach 281 tons. The waterways, each 8 ft. × 18 ft., controlled by these valves are opened or closed by means of a rising valve stem, connected at the lower end to the valve and at the upper end to a crosshead, which is actuated by two vertical, revolving, non-rising screws, motor-driven by reducing gear from the horizontal shaft, through a friction cut-off coupling. The motor is provided with a solenoid brake, whereby the revolving parts may be brought to rest immediately after interruption of the line current; a limit switch cuts off the current at the proper time in the travel of the crosshead, and the friction coupling has been introduced to prevent injury to the mechanism in the event of over-travel.

The duty of the cylindrical valves is to control the flow of water from the centre wall culverts into the lateral culverts beneath the lock floors, whence it rises through wells into the lock chambers. Such control is necessary in the case of the middle walls, in order that the twin chambers on either side may be used independently of one another. Owing to the position of these valves at a somewhat higher level than those installed in the side wall culverts, the maximum pressure to which they will be subjected is less. They will also, under ordinary conditions, operate under a comparatively low head, it being intended, as a general rule, to use the middle culvert only towards the close of a lockage, when the difference in level between the two pools has been considerably reduced through the operation of the side wall main and lateral culverts. Having regard, however, to the fact that they may receive pressure from either direction, their strength is proportionately equal to that of the Stoney gate valves, the moving parts of each valve weighing in air not less than 3·4 tons.

These valves consist primarily of two concentric hollow cylinders, one stationary and the other moving within it, having a diameter of 7 ft. 1¾ in. The diameter of the culvert below the valve is 6½ ft., and this opening is closed when the movable cylinder is at its lowest position, pressing against a turned metal surface, known as the valve seat. The stem by which the movable cylinder is raised or lowered passes through a metal casing to the operating machine, and has fastened to its upper end a non-revolving nut, which, together with the valve stem and valve, is moved vertically through a distance of 3 ft. 3 in. by means of a revolving screw, actuated by a bevel gear, driven by a pinion on an extension of the motor shaft. A combination casing and bedplate carries the motor, limit switch, bearings and all moving parts; and a small oil pump, geared to the motor shaft, lubricates the thrust and motor shaft extension bearings.

At the preliminary test of two of these valve machines, to which I referred in a preceding article, the machines were operated under various conditions, with weights of 9,000 and 14,000 lb., and through 100 cycles at intervals of from one to three minutes. It was then found that turbine oil, used as a lubricant, proved so light that it was thrown or squeezed out by the centrifugal pressure, and accordingly a heavier oil was substituted. The following were the results of the tests for a machine subsequently mounted in the centre wall of the upper locks at Gatun :—

	Up. 9,000 lb.	*Down.* 9,000 lb.	*Up.* 14,000 lb.	*Down.* 14,000 lb.
Stroke	36 in.	36 in.	35½ + 1⅜ in.	31½ + 1⅜ in.
Time	—	—	11·4 sec.	9·4 sec.
Running torque ...	86	—	112	—
H.P. at coupling ...	10·8	—	13·0	—
Amperes	34	18·5	44	20
KW. at motor terminals	10·9	*0	14·1	1·27
Machine efficiency ...	—	—	51·5 %	—

* Efficiency is the ratio of energy input to the motor, divided by actual energy output. This accounts for both electrical and mechanical losses.

For operating the lock-valve machinery, the Canal Commission have expressed a special desire to secure motors which have been developed and successfully used for at least a year in connection with steel-rolling mills—the service deemed best comparable with that required in the Isthmian locks. This, of course, will be intermittent, and the motors will be worked necessarily under conditions demanding more than the ordinary safeguards against the excessive moisture of the Isthmus and its deteriorating influences. Upon arrival in the Canal Zone, the eight motors purchased from three manufacturers were placed in a dry room in the store-house at Gatun, and there subjected to the following tests :—

(*a*) Measurement of their insulation resistance and the application for one minute of a 1,500-volt high potential test;

(*b*) Measurement of their insulation resistance immediately prior to turning on steam and, subsequently, at intervals of six hours;

(*c*) The removal of the handhole covers to admit to the room saturated steam, with a view to increasing the temperature of the air to 50° C.; and

(*d*) The application of a high potential test of 1,000 volts during 10 seconds every 24 hours.

The effects of these trials, which were to be continued during a week, are yet unknown, and probably will not be disclosed until after the two further series of tests resolved upon, should the data obtained from the first series fail to show quite definite results. The second and third stages have been thus described :—

(2) The tests to be continued, but in a temperature of 75° C. In addition, the motors will be immersed in water at normal air temperature, and the insulation resistance will be measured just prior to and after immersion. At intervals of six hours during two days just prior to removal from the water, a high potential test of 500 volts will be applied for 10 seconds.

(3) Internal heat will be applied by running the motors on regular or at higher pressure to produce the desired heating effect. This test will show the rapidity with which the moisture in the insulation will be driven off, and will also render the insulation more porous and finally weaken it as to its insulating properties.

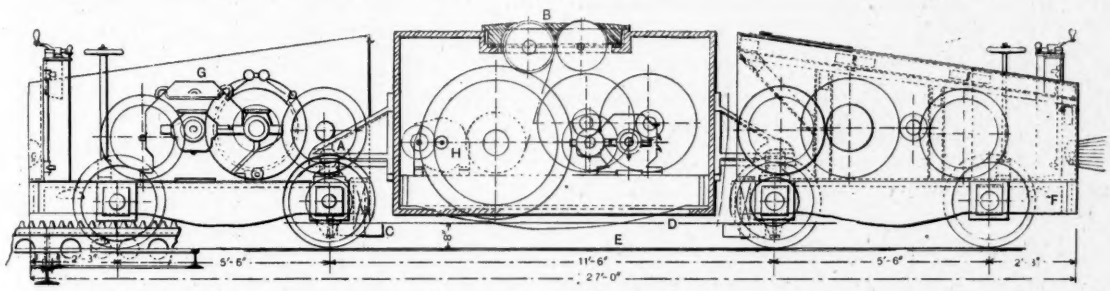
Much interest attaches to the plans and regulations adopted by the Canal Commission to ensure the safety of the locks and of shipping during its transit of the latter. Experience has shown that accidents in such connection have resulted almost invariably from misunderstood signals in the

engine room ; and the obvious remedy, therefore, seems to be to eliminate the dangerous factor by conferring upon the Canal authorities control of all vessels while passing through the locks. This, as a consequence, demands the assumption by the United States Government of responsibility to shipowners in the event of damage, and to this end legislation at Washington is urgently necessary. Congress, however, despite the prospect of an early completion of the undertaking, continues conspicuously negligent of its duties in the matter, and, as in connection with the more important question of dues, refuses consistently to disclose its views.

The system adopted for lock navigation has been devised and patented by Mr. Edward Schildhauer, of the Canal engineering staff, the United States Government having the right to use it without remuneration. It provides for the passage of a ship through the locks at a speed of 2 miles an hour, the vessel being controlled and held steady between four lines of taut hawsers. These will be attached, two forward and two aft, when the ship, according to regulations, has come to a full stop in a lock forebay. Each of these hawsers at its other end will be connected to the windlass of an electric towing locomotive, with the result that two locomotives, moving on rails on opposing lock walls, will tow the vessel, and two others similarly placed will be towed by their hawsers, and thus steady the ship. The locomotives will run on a level, except in a flight where they pass from one lock to another. In such cases, as, for example, between the lower and intermediate locks at Gatun, where there is a difference in elevation of 29 ft. 7 in., they will be required to climb heavy grades.

There will be on the three lock walls two systems of rails, one for towing and the other for the return of the locomotives, and the only crossovers between them will be at the lock ends. The gauge will be 5 ft. P.R.R., and the rails, of open-hearth steel, laid on Carnegie steel sleepers, each anchored into the concrete by a bolt on the side further from the lock chamber. On the centre wall there will be, of necessity, two sets of towing rails with a return track, common to both, between them. Throughout their length the towing tracks will be provided with a centre rack, and on this when towing, and also when returning on an incline between locks, the locomotives will always operate ; elsewhere, however, they will run by friction. The racks will be of cast-steel, the distance from centre to centre of adjoining teeth being 3·13 in., and they will be so formed that lubricant shall not fall upon the concrete or water collect where likely to serve as a breeding place for mosquitoes. After hauling a ship through the last gate and into the lock approach, the escorting locomotives will coil their hawsers and return, or take control of a vessel proceeding in the opposite direction.

As will be seen from the drawings accompanying this article, each locomotive consists of three parts—two tractors and, between them, a windlass. The last will not be mounted upon a truck, but be supported by two arms extending from each side of the two ends and resting upon bearings immediately over the rear wheels of the tractors. The ends of these arms will be equipped with rollers to permit free horizonal movement of the members when the locomotive is rounding a horizontal curve ; and, in order to ensure free movement of the parts when the locomotive is on a vertical curve, the windlass is connected with the tractors by a drawbar and trunnion, having the effect of a universal joint. The two tractors are alike in every particular, and will run as rack or friction locomotives at the will of the operator, by whom the whole locomotive can be controlled from either cab.



A, Universal connection ; B, Tow line, maximum pull 25,000 lb. ; C, Thrust wheel ; D, Pitch line of rack ; E, Top of coping ; F, Gong ; G, Traction motor ; H, Winding motor.

Fig. 8.—Electric Towing Locomotive. Side Elevation.

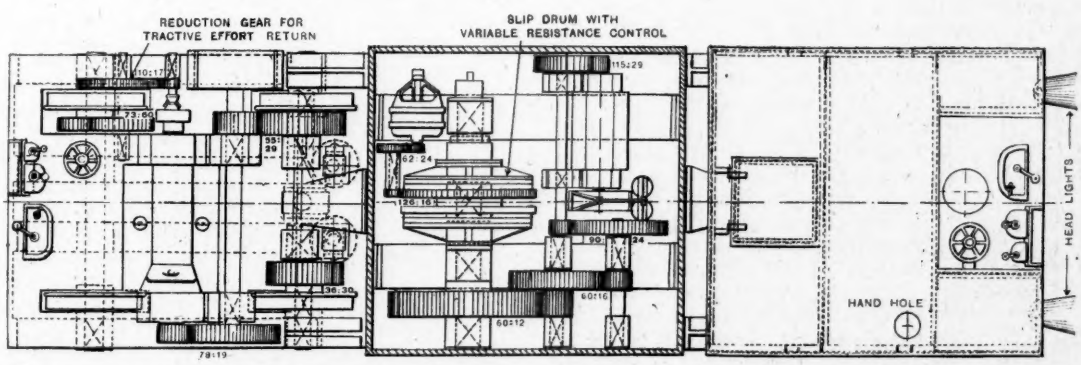


Fig. 9.—Electric Towing Locomotive. General Plan.

When towing, and on the inclines between locks, the tractor will run as a rack locomotive, motion being communicated from the motor to the rack pinions by means of a system of gear reduction absolutely without clutches. This train of gears cannot be disconnected in any way, and, as a result, the rack pinions will be in motion only simultaneously with the motors. A solenoid brake, closing upon a brake wheel when the current is cut off from the motors, provides against accident in such event, while the locomotive is on an incline. Should the current be then cut off, the locomotive would come to a stop instantly and be held fast until the release of the brake. Each rack pinion is of quill construction, and so mounted upon the back axle of each truck as to run free from the motor when the locomotive is on the return rails and travelling by friction. For such travel—at a rate of 5 miles an hour—the tractors will be fitted with jaw clutches, operated by solenoids and connecting the traction motor with the driving wheels.

The electrical equipment for each tractor consists of one traction motor with control apparatus. The motor will be three-phase, induction, totally enclosed, high torque, or mill type, 25 cycles per second, with 220 volts between lines. It

will have a full speed torque of 840 lb. at 1 ft. radius, full load speed at no less than 470 R.P.M., and be capable of developing 75 per cent. greater torque for a period of one minute. Alternating current will be used, with the effect that synchronous speed will be maintained by all four locomotives engaged in a tow. The motors on the tractors of each locomotive will be operated in parallel, and controlled by resistance in the secondary circuit, this being accomplished by contactors in the primary and secondary circuits operated by master controllers of the drum type, one in each cab. There will be not fewer than seven points in each direction, and between these and the braking position will by a coasting point, available when power is turned off from either forward or reverse direction. Current will be collected by each tractor by means of a plough carrying two contact shoes, each operating on a separate power rail carried in an open conduit, one for each of two phases, the third being carried by the two outer rails. The maximum load which will be thrown upon the traction motors will occur when the locomotive is ascending an incline, and this will be greater than the load of towing a ship. Consequently, as weight is not required for tractive effort, the locomotives, as designed, will be as light as possible, the estimated weight of each being approximately 31¼ tons.

The duty of the centre unit, all the movements of which will be controlled by rotary switches in either tractor cab, will be to pay out or haul in the towing line. For this purpose there is provided a winding drum, 18 in. in diameter, which will be prevented by a friction clutch from ever sustaining a pull of over 25,000 lb. In this unit there will be two motors, one for operating the windlass under load, and the other for rapidly coiling the hawser. The former will have a full-speed torque of 120 lb. at 1 ft. radius, be capable of 50 per cent. greater torque for one minute, and have a minimum full-head speed of 630 R.P.M. The coiling motor will have 30-lb. torque, be capable of exerting an addition of 50 per cent. for one minute, and have a full-load speed of 630 R.P.M. Except that they will be of the squirrel cage type, these motors will have the same classification as those in the tractors.

The towing line will be of plough-steel wire, composed of six strands of 37 wires each, have a hemp centre, and be 1 in. in diameter. The wires, according to specification, must have a minimum tensile strength of 225,000 lb. per sq. in., and the hawser, as a whole, must have an ultimate breaking strength of not less than 70,000 lb. At the ship end there will be a 4-ft. loop, and the length of the line from the centre of this to the windlass drum will be 215 ft.

A steel housing will enclose all the machinery for both tractors and windlass, that of the latter consisting of a steel frame covered with $\frac{3}{16}$-in. plate. The top sheeting must be capable of sustaining a strain of 85 lb. per sq. in., and the upper side edges of the housing the concentrated load of 12,000 lb. which may be placed upon it when the hawser is used to warp a vessel up to the lock wall, and the line is at right angles to the locomotive, and the chock of the ship considerably below the latter.

About 11,000 tons of material will, it is estimated, be used in the construction of the permanent way for the towing locomotives. The larger items making up this total are 2,000 tons of steel rails, 1,434 tons of steel sleepers, 2,923½ tons of carbon steel rack castings, 859 tons of rolled steel conductor-slot covers, 568½ tons of steel channels, 831,744 lb. of copper conductor rails, 721,250 lb. of steel conductor rails, and 445,000 lb. of malleable iron castings, with smaller quantities of sleeper clips, bolts, nuts, splice bars, rivets, insulators, &c. Of the copper conductor rails 127,000 ft. will be required. They will be made by the extrusion process in modified "T" sections, 22½ ft. long, with straight sides and a return at the base—2½ in. wide at the base, 3⅛ in. leg, and weighing 6·07 lb. per ft. Five tenders were opened recently at Washington for the supply of 40 electric locomotives—one sample and 39 others if the first proves satisfactory. The prices quoted ranged from £170,600 to £100,600, and the order was placed with the General Electric Co., the lowest bidder.

For this survey of the more important applications of electrical power to the operation and navigation of the Panama Canal, it has been found necessary to exclude reference to many uses and details which might possibly have proved of equal interest to the electrical engineer and student of electrical progress. Sufficient, however, has surely been said to justify the primary purpose of the articles, namely, that of indicating the very pronounced position, greater even than that held during the period of construction, which electricity will occupy in the practical working of the canal. That the latter, when completed, will prove to be the greatest triumph of civil and mechanical engineering the world has yet seen, goes without saying. It must not, however, be forgotten that to this triumph there have been many contributories—that it would have been well-nigh impossible under other political and economic conditions; without the sanitary

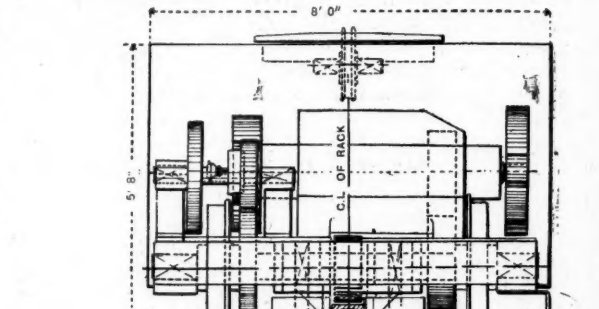


Fig. 10.—Electric Towing Locomotive. End Elevation, Cover Removed.

organisation which has made the Canal Zone not only habitable but conspicuously healthy; without the far-reaching administration which has fed, clothed and housed and held itself responsible for the physical and moral well-being, at work and during leisure, of a labour army often exceeding 40,000 strong.

A similarly expansive view should be taken of the canal when opened for traffic. We must cease to regard it merely as a great maritime highway; for the future has in store for it other services to mankind. Allied to it will be facilities destined, in the writer's opinion, to make the Canal region foremost among the world's coaling stations and general trade distributing centres. Were this result beyond the bounds of possibility, there would be scant excuse for the large outlay involved in the harbour extensions now in progress and contemplated near each ocean terminal. To the already considerable dock and harbour facilities at Colon and Cristobal there are being added, on the Atlantic side, five reinforced concrete docks, absolutely protected from "northers," and capable of accommodating at one time 10 1,000-ton vessels, or 20 ships of the type now engaged in the Isthmian trade. Even more significant are the plans for creating at Balboa, a few miles inland from Panama Bay, great lumber, coal and other docks, at which the largest vessels afloat may tie up and load or discharge cargo. Here also will be built a dry dock, 1,000 ft. long, 100 ft. wide at the floor, and 140 ft.—21 ft. greater than the corresponding dimensions of the two largest similar structures at the Admiralty Dockyard at Portsmouth—wide at the coping level. Quite pertinent to these articles is reference to the above-mentioned works, for at the dry dock at Balboa will be erected gates similar to the largest of the lock gates and electrically operated in the same manner, and throughout all the docks electric power will be almost exclusively used. And the same remark probably will be found justified in relation to the fortifications and batteries now in course of construction near each terminal for the defence of the Canal against naval attack.

Radio-Telegraphic Convention.—The Portuguese Government has notified the German Government of the adhesion of its colonies and dependencies to the Convention.

PROCEEDINGS OF INSTITUTIONS.

The Electrical Driving of Rolling Mills.

By C. A. Ablett, B.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Sheffield, January 10th, and London, January 11th*, 1912.)

The power which is required to drive a rolling mill generally varies rapidly between wide limits, while the condition that power should be generated cheaply is that the demand made for power on the generating plant should be maintained steadily at the full capacity of that generating plant. To ensure that the working costs of a rolling mill should be low, means must be found for reducing the fluctuations in the power required to drive the mill, care being taken in doing this that the capital cost of the plant is not unduly increased nor is the possible output reduced. Any reduction of the possible output is equivalent to an increase in the working cost, as the capital charges per ton are increased.

The variations in power are reduced by employing a fly-wheel in conjunction with the electric motor which is used to drive the rolling mill, and by providing some device for reducing the speed of the motor and fly-wheel to enable the fly-wheel to give out some of its stored energy when the demand for power is great, so as to reduce the power which has to be furnished by the motor. When the demand for power is small the motor will speed up the fly-wheel, thereby replacing its stored energy; this increases the power which the motor has to supply when the demand made by the mill is small, and therefore reduces the total variation in power.

Leaving large reversing rolling mills out of consideration, the largest variations in power occur in tin-plate and sheet mills. With merchant mills and bar mills the variations in power are less, while in the ordinary looping mill for rolling wire rod, where the rod may be in six pairs of rolls at once, and where a fresh rod is entered while the previous one is still in the rolls, the power required to drive the mill does not vary much.

The ordinary direct-current shunt-wound motor, or three-phase induction motor running at light load, will fall in speed by, say, 2 per cent. when it is required to give its full power. The stored energy of the fly-wheel varies as the square of the speed at which it is running, so that if a fly-wheel were used in conjunction with this motor it would only give up 4 per cent. of its stored energy as the power increased from light load to the full power of the motor.

If the mill required a power equal to four times the normal full load of the motor, the latter could give twice its normal load for a few seconds, falling 5 to 6 per cent. in speed, and the fly-wheel has to furnish the remainder, but would only give up 10 or 12 per cent. of its stored energy.

It is therefore necessary artificially to increase the fall in speed of the motor as the power which it has to give increases. If the speed falls by, say, 10 per cent. as the power increases from zero to full load, and, say, by 22 per cent. as the power increases to the double full-load power, the fly-wheel would have given up 39 per cent. of its stored energy by the time that the motor was giving double its normal full-load power, instead of from 10 to 12 per cent.

There are two possible devices for artificially increasing the fall in speed of the motor as the power demanded increases. These are commonly spoken of as the permanent-slip regulator, and the automatic-slip regulator, but both devices perform their functions automatically, and it would be better to call them the continuous-slip regulator, and the intermittent-slip regulator. The former is the more commonly used in practice.

In the case of the direct-current motor the continuous-slip regulator consists of an ordinary compound winding provided for the field-poles, while the intermittent-slip regulator consists of a system of relays which successively short-circuit resistances in series with the shunt field winding, thus increasing the field and causing the speed to fall when the power has reached a certain predetermined point.

In the case of the three-phase motor, the continuous-slip regulator consists of a resistance, liquid or metallic, permanently inserted in the rotor circuit, while the intermittent-slip regulator may consist either of a liquid resistance, the moving plates of which are controlled by a motor relay, so that the plates are raised and the rotor resistance increases when the current has reached a predetermined point, or a metallic resistance which has its various sections short-circuited by a series of relays, so arranged that these relays cut the resistance into the rotor circuit when the current has reached the predetermined limit.

Continuous-slip Regulator.—Within the limits of fall in speed or slip of the motor it can be assumed that the stored energy given up by the fly-wheel is proportional to the slip, without involving any large error, therefore the power given by the fly-wheel is proportional to the rate of change of the slip—that is, to the rate of change of the motor power. It will thus be seen that if a sudden increase of load is imposed on the motor and fly-wheel by entering a bar between the rolls, and a curve is constructed showing the increase of motor power with the time, this curve will be a logarithm curve; while if the power required by the mill suddenly decreases owing to the bar leaving the rolls, the motor power decreases according to a logarithm curve. The curves showing the rise and fall in speed of the motor and fly-wheel are also corresponding logarithm curves.

If I = moment of inertia of fly-wheel, v = the speed, and K the motor power, the expression $\frac{I v}{K}$ expressing the relation of motor power to fly-wheel capacity is the "time constant" in this case and is exactly analogous to the "time constant" in the case of the heating or cooling of electrical machinery.

The value of the time constant for a motor and fly-wheel, however, does not usually exceed about 33 seconds. The value of the time constant to be selected naturally depends on the type of mill. In a sheet mill, where the duration of the passes is very short, the time constant need not be so big as in the case of a bar mill, where the finishing passes may take a considerable time. The greatest time constants are found in the case of motor and fly-wheel for the motor-generator set of an Ilgner electrically-driven reversing rolling mill.

The following table shows how the percentage variation in power changes with different weights of fly-wheel and with various durations of pass and interval:—

	Average power, H.P.	Percentage variation of power. 50-ton wheel.	25-ton wheel.	12½-ton wheel.
Pass 5 sec., interval 5 sec....	350	14·2	28·2	54·5
Pass 5 sec., interval 2½ sec.	433	7·7	15·3	30·0
Pass 2½ sec., interval 5 sec.	267	12·6	25·0	48·5
Pass 15 sec., interval 15 sec.	350	41·8	76·0	120·0

In this table the percentage variation is expressed with relation to the average power; it is thus possible to obtain variations greater than 100 per cent.

The table shows that the percentage variation of the power increases as the weight and consequently the stored energy of the fly-wheel decreases, but that this increase is not proportional to the decrease of stored energy, but increases at a slower rate than the stored energy decreases.

Although for each particular figure the average power remains the same whether a light or a heavy fly-wheel is employed, a somewhat larger motor would be required with the light fly-wheel than with the heavy wheel, because the motor size is settled by the root-mean-square current and not by the average current, and where the variation of power is great the root-mean-square value is naturally greater than where the variation is small.

Alarm is raised from time to time in cases where work is being carried on very rapidly, so that there is only a very short interval between passes, to the effect that the fly-wheel may not have time to recover itself between the intervals and passes. Such alarm is entirely without foundation. If the intervals are short, then naturally the average power increases, while the percentage variation of power is reduced. As the average power is increased the motor is supplying greater power to the fly-wheel during the interval, and although this interval may be short it is able to restore the stored energy of the fly-wheel.

Where the passes are long the fly-wheels are less effective in reducing variations of power than where the passes are short, and heavy fly-wheels are required if the percentage variation in power is to be kept small.

The following general conclusion may be drawn from these curves, namely:—

Where the time of the interval is short a light fly-wheel will enable the percentage variation of power to be kept moderate, but if the time of the interval is long, the heavier fly-wheels must be used.

In practice the question is not so simple, because the various passes in rolling down a billet to a definite section require widely differing powers, while the times of the passes and of the intervals also differ widely.

In certain cases a heavier fly-wheel must be used in conjunction with a three-phase motor than with a direct-current motor, in order to obtain the same results.

In any mill the bar is elongated in each pass, so that each successive pass taken in the same pair of rolls takes a longer time than the previous pass. Frequently less draught is taken in each succeeding pass than in the previous pass, so that the tendency is for the power diagram to consist in the earlier passes of large powers lasting for a short time, and for the power gradually to diminish and the time to become longer as the later passes are reached. There are many exceptions to this.

Fig. 1 (p. 236) is an illustration of a practical case, being a series of curves obtained for a bar mill, and this serves to show the sort of variation of power and speed to be found in practice. The bar mill had two stands of rolls, a roughing stand and a finishing stand, and as bars may be in both stands at the same time, account has to be taken of the power required when two passes come simultaneously.

The motor power reaches 620 H.P. as a maximum, although in one case, where two bars are in the rolls together, the mill requires 1,220 H.P., while the minimum value is 295 H.P. As the mean H.P. is 434, the percentage variation is 76 per cent. If no fly-wheel were used, the percentage variation would be 267 per cent. This practical example illustrates the benefit of the fly-wheel in a striking manner.

Speed variations of 22 per cent. between no load and double full load have been mentioned, but no such variation may be expected in practice where the work at the mill is being carried out fairly steadily, because, with steady working, the power never comes down to no load, neither does it reach double full load except in very exceptional conditions.

In the case of fig. 1 the speed variation of the motor is 20 per cent. between no load and full load, but in the curve the speed variation does not exceed 11·2 per cent.

Intermittent-Slip Regulator.—A type of intermittent-slip regulator suitable for direct-current motors, consists of a small motor

relay, the field of which is excited by the main current passing through the mill motor armature. The armature of the motor relay is excited by a pressure winding which is placed across the mains supplying the main mill motor. The armature is restrained from moving by means of a spring, so arranged that when the current in the main circuit exceeds a certain value, the turning moment of the armature of the motor relay overbalances the spring, so that the armature makes a slight movement. This movement of the armature successively makes contact with a number of fingers, which energise relays, which successively connect resistances in parallel with the resistance in the main motor shunt field.

A form of intermittent-slip regulator adapted for use with three-phase motors consists of three liquid resistances with movable plates, one placed in each phase of the rotor circuit. A motor relay is provided in this case, the windings of the motor stator being either in series with the mains supplying the main mill motor, or

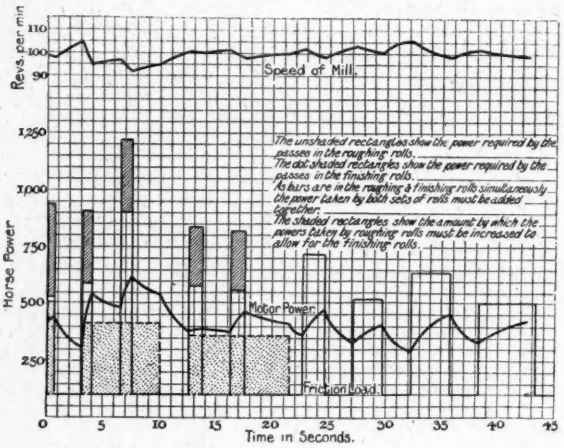


Fig. 1.—Typical Example of the Variation of the Power and Speed of a Rolling-Mill Motor under Practical Conditions.

else supplied through a current transformer. The rotor of the motor relay is prevented from moving, either by a spring or by a weight slung from a band passing over a pulley on the motor shaft. When the current in the main motor exceeds a certain predetermined value, the turning moment given by the motor relay overbalances either the spring or the weights, allowing the armature to turn a certain amount, thereby raising the plates in the liquid resistance by means of a belt passing over another pulley on the motor shaft. The raising of these plates increases the resistance in the rotor circuit of the mill motor, thereby causing it to fall in speed.

The action of the intermittent-slip regulator is very different from that of the continuous-slip regulator. This intermittent regulator comes into action when the power given by the motor attains a certain value, and when this point is reached a very slight increase in power indeed will cause the intermittent-slip regulator to act to its fullest extent.

Theoretically speaking, therefore, the power can be maintained at its average value with a deviation of perhaps less than 1 per cent., so that the power curve is practically a straight line, and does not rise and fall in accordance with logarithm curves, as is the case with the continuous-slip regulator.

The speed will fall during the pass, and will rise again in the interval between passes, in accordance with the straight-line law, and there will be no logarithm curves for the rise and fall in speed. On theoretical grounds, it appears to be a very ideal mechanism as compared with the continuous-slip regulator.

In practice the great difficulty with the intermittent-slip regulator is that it is comparatively slow in coming into operation on account of the inertia of the various moving parts. Instead of reducing the power to the mean value, it actually is the means of producing very bad peaks indeed.

In many cases, particularly the earlier passes of a roughing mill, which is roughing down the billets in order to feed an ordinary merchant mill, the passes may easily be of less than one second duration. In such a case the intermittent-slip regulator would be absolutely useless, and unless a very large motor were provided the circuit-breaker would be continually coming out.

The case of a looping mill rolling wire rod would be a good one for the installation of the intermittent-slip regulator, because the power demanded from the motor does not rise suddenly but gradually as the rod is looped into the various pairs of rolls, and the power demanded also increases gradually, so that it gives time for the intermittent-slip regulator to come into operation.

The intermittent-slip regulator also finds application for regulating the speed of the fly-wheel motor-generator set for supplying an electrically-driven reversing rolling mill on the Ilgner system.

Where a three-phase rolling-mill motor is used the use of resistances entails a certain waste of power proportional to the amount by which the speed falls. Careful tests have shown that there is practically no difference between the loss of power taking place in either form of slip regulator.

The choice of the power of a rolling-mill motor and of the weight of the fly-wheel used in conjunction with it, so as to obtain that relation between motor power and weight of fly-wheel that will reduce the cost of power to a minimum, depends on whether power is being generated in the works, or purchased from outside; in the latter case there are various systems of charging for power which materially affect the most favourable proportions between motor and fly-wheel to be adopted.

Where there a number of rolling mills in one works, all doing somewhat similar work, and usually all working together, the probability is greatly in favour of the variations in the power taken by the various rolling-mill motors balancing one another, so that the total power required remains at a fairly constant value, even though fly-wheels of quite moderate weight are used with the mill motors. This fact of natural balancing is fully borne out by practical experience, and such a case is an ideal one for cheap electrical driving.

Power Generated within Works.—In this case the power to be supplied by the power station should be kept as constant as possible. If there are only one or two rolling-mill motors and a considerable amount of small machinery of which the power demand will keep fairly constant, heavy fly-wheels should be used with the mill motors, and the slip regulators arranged so as to allow as much fall in speed as is consistent with obtaining the output from the mills, so that as much of the stored energy of the fly-wheels as possible may be available for reducing fluctuations in the power.

There is a definite economic limit to the weight which may be adopted for the fly-wheels because increase in the weight increases both the frictional losses and the capital charges on the plant, and a point will be reached where the increase in running costs due to these frictional losses and increased capital charges will balance the saving effected by running the generating plant at constant load.

If, on the other hand, there are a large number of rolling mills, all of which are likely to be working simultaneously, it would be advantageous to reduce the fly-wheel weight, relying on the natural balancing effect to keep the load constant.

Power purchased from a Supply Authority on the Maximum Demand System where Instantaneous Peaks are Registered.—This case is similar to the above, as means must be adopted for keeping the power as near to the average value as practicable.

Power purchased from a Supply Authority at a Flat Rate for the Number of Units Consumed.—In this case all friction losses should be kept as low as possible in order to reduce the total number of units consumed, while there is no object in attempting to prevent variations in the power. But motors large enough to deal with the largest power required by the rolling mill would prove more expensive in capital cost than a more moderate size motor used in conjunction with a fly-wheel of moderate weight.

Power Purchased from a Supply Authority on the Maximum Demand System where Peaks of Several Minutes' Duration only are Taken Account of.—This system of charging is much in favour with the various supply authorities, and the remarks made with regard to the last case apply to this case also. The variations in power required by most rolling-mill motors are very rapid, and the peaks last for a matter of a few seconds only, so that they will not be registered by the maximum-demand indicator.

The Ilgner System for Driving Large Three-high Mills.

During the first passes in the roughing rolls, the billet is very short. While the actual power taken may be large, the time of the pass is short, so that the amount of energy consumed is comparatively small and the fly-wheel does not have to give up much stored energy. In the last passes, where high speed is most desirable to get the bar through the rolls quickly on account of its great length, the speed of the motor has fallen to the lowest limit, and this causes reduction of the tonnage which it is possible to roll.

To overcome this difficulty, several steel works have adopted the Ilgner system for driving large three-high mills—the same type of electrical plant which is generally employed for driving reversing rolling mills. In this system, the fly-wheel is not coupled to the mill, but is coupled to a motor-generator set which supplies current to the mill motor. As the mill motor runs at a constant speed whatever power it is required to give, there is no reduction in tonnage owing to reduction in speed in the mill, but the motor-generator set, instead of the rolling-mill motor, varies in speed so that the fly-wheel can give up its stored energy when the power demand is great, and absorb energy when the demand is small, so as to reduce the variation in power taken from the supply system to a reasonable value.

In such a case the motor driving the motor-generator set and the fly-wheel shows variations of speed and power similar to those described in the earlier part of this paper for a mill motor and fly-wheel, except that in this case the variations in power are very much reduced; partly because the motor-generator set runs at a comparatively high speed, so that the stored energy of the fly-wheel is very much increased, although its weight and cost may be much reduced, and partly because a much larger variation in speed is permissible, as there is no fear of reducing the tonnage of the mill by allowing the variations in speed to be too great, so that a much greater proportion of the stored energy of the fly-wheel can be utilised to reduce power variations.

By regulating the field current of the generator of the motor-generator set, the voltage of this machine may be varied, causing the speed of the mill motor to increase or decrease correspondingly, and as there is no fly-wheel coupled to the mill motor the speed of the latter may be increased or decreased very rapidly. In rolling down a billet or bloom, therefore, it is possible to drive the mill at such a speed that while the first passes are being made the billet can easily be handled, and then to increase the speed con-

siderably for later passes when the billet has been rolled into a long bar, and when each pass takes a considerable time, so that the times of these long passes can be reduced.

In this way the total time for rolling down each billet can be reduced, and the tonnage can be increased. The time taken by these later passes can still further be reduced by increasing the speed after the bar has entered the rolls and then decreasing the speed again before the bar leaves the rolls, so that it is not thrown out at too high a speed. By using the Ilgner system, therefore, the possible output from the mill can be increased beyond that which would be obtained if the mill motor were driven at a constant speed.

Where the Ilgner system is adopted, it is always possible to use the mill as a reversing mill if a section has to be rolled which is difficult to manage in a three-high mill.

The Ilgner system has been adopted, amongst other examples, for driving a three-high mill having three stands of rolls and rolling heavy beams, driven by a direct-coupled motor of 12,600 H.P. normal output. The fly-wheel motor-generator set, which is provided with a 55-ton fly-wheel, runs at a maximum speed of 428 R.P.M., and is driven by a 2,600-H.P. motor.

The roughing rolls of a merchant mill should be run at the highest speed at which it is found practicable for the men to catch the comparatively short billet, and as in most cases about the same size of billet is being rolled, the speed should remain constant. The finishing rolls, on the contrary, should be capable of running at a large number of different speeds according to the shape and weight of section being rolled.

The ideal drive, therefore, is to provide a constant-speed motor for the roughing mill and a separate variable-speed motor for the finishing mill. Where the power available is direct current, this arrangement presents no difficulty, but where three-phase current must be used, the means of providing a variable-speed drive for the finishing mill needs some consideration.

An arrangement which can only be used where a rope drive can be employed is to provide an ordinary three-phase motor having three rope pulleys of different sizes on its shaft, and to change the ropes from one pulley to another when different speeds are required for the mill.

This only enables three possible speeds to be obtained, and has also proved itself to be very wasteful in power. A better plan is to convert the three-phase current to direct current, and then to provide a direct-current rolling-mill motor, so that the speed can be varied to suit all conditions without wasting power.

A still more economical arrangement for obtaining variable speed has been adopted for three merchant mills in this country. This consists of employing a three-phase motor direct coupled to a direct-current motor for driving the mill. A rotary converter is connected to the rotor circuit of the three-phase motor, so that when the set is run at reduced speed the power which would otherwise be wasted in resistances in the rotor circuit is converted by the rotary converter from three-phase to direct current, and then used usefully to supply the direct-current motor.

The conversion losses are reckoned on a fraction of the power, and not on the entire power, so that the arrangement is much more efficient and is cheaper in capital cost. With this arrangement the direct-current motor is provided with a compound winding to act as a continuous-slip regulator, and the combination behaves like an ordinary compound-wound direct-current motor, the speed being varied by altering the resistance of the shunt field circuit of the direct-current motor.

Generally speaking, where there is a choice between direct current and three-phase for driving a mill for which variable speed is desirable, and there is little or no difference in the cost of current, direct current will be found the most economical.

Particular care should be taken to reduce as much as possible the friction losses, or other such losses which have a constant steady value independent of the power which the rolling mill may be giving. If the average power of a rolling-mill motor is one-third of its rated output, as is often the case, a friction loss which may be only 10 per cent. of the rated output will increase the total units consumed in a given time by 30 per cent. These remarks apply particularly to rope drives when used for rolling mills, as it is usually stated that a rope drive involves 10 per cent. loss of power, but this only applies to the case of a motor which is constantly transmitting its full power through the rope drive.

In many mills the power consumed by the friction of the mill itself is about one-fifth or one-sixth of the normal rated output of the motor which is installed to drive the mill, so that nearly 50 per cent. of the units of electricity used per ton rolled are wasted in friction. This shows how great an opportunity there is for improvements and for effecting economies in the cost of rolling.

Various economies can be effected by electrical driving when properly applied, but one of the principal economies is that of the cost of power. The electrical drive often enables cheap power to be used when it could not be transmitted or applied in any other way, and also in many cases it affords a means of enabling power to be generated cheaply, so that in planning an electrical drive every care should be taken to make use of its natural advantages as far as possible.

Discussion at Sheffield.

Mr. S. Eckmann said that where the passes were long and the intervals short, the motor energy approached the load on the rolling-mill shaft very closely. The fly-wheel therefore did very little work, and was hardly worth the money or the space or the additional running costs caused through friction. British firms nowadays built motors which could be connected directly to finishing rolls without the insertion of either a fly-wheel or an elastic coupling, and therefore a fly-wheel was not even necessary for protecting the motor. The curves showing the action of the fly-wheel were somewhat misleading, as the horse-power taken by the rolls had been assumed constant during one pass, whereas the horse-power was proportional to the speed. The figures giving the percentage variation of power therefore should be read with caution. The reason why automatic slip regulators were not used more frequently was that the regulator at one time could only be adjusted for a certain average load. The average load on a mill was dependent chiefly on the sections rolled, the temperature and the output of the mill, so when the rollers were working hard they were hampered by a slip regulator. A rolling mill drive should be able to follow the fluctuations of the output. Such a drive was given, for example, by an A.C. motor with constant resistance in the secondary or by a compound motor. With regard to the statement of the author that the arrangement with rope drive was wasteful, he did not see why this arrangement should be very wasteful. There was a slip-ring motor with, say, 92 per cent. efficiency at full load, there was a permanent resistance in the motor which brought the efficiency down to about 87 per cent., and there was finally the rope or belt drive. If a belt drive was chosen as being the more efficient of the two, the efficiency at full load would go down to about 84 per cent. This figure did not include the fly-wheel friction losses. The belt drive naturally involved a certain loss, say 4 per cent., but, on the other hand, a directly-coupled motor was a slower speed motor, and less efficient. He believed that, taking costs and overall efficiency into account, the indirect drive was often justified. The three-step belt drive was considerably more efficient than the Ilgner system. Careful investigations had shown that the rotary converter with one direct-current mill motor and the Kramer system were very much alike, both as regards efficiency and first cost. The former had only two revolving machines, whereas the Kramer system involved five rotating machines for one mill. The former required less space on the mill, and one rotary could be used for more than one mill. Thus for three mills there would be required four revolving machines, whereas with the Kramer system at least 11 revolving machines were required. Again, with the former the current taken from the line was always at unity power factor, whereas with the mixed motor system the power factor could not be kept at unity. There would be heating trouble when the rotary ran at low speed. He would like to ask what provisions were made in the Kramer system in order to obtain good compounding at low speed. In his opinion the efficiency of the electrical drive had been somewhat overrated. It did not matter much whether the electrical drive was 1 or 2 per cent. higher or lower as long as the overall efficiency of the mill was absolutely dominated by the friction losses in the mill itself and by the output.

Mr. A. du Pasquier took exception to Mr. Ablett's remarks with regard to three-phase motors rope driving merchant mills of medium size, arranged with pulleys to give three efficient speeds. He knew of mills so operated with highly satisfactory results. Unquestionably a system of drive giving economic uniform speed control was preferable, if the extra capital outlay to secure it could be justified, but the question of the return on outlay had always to be borne in mind. Further, he thought Mr. Ablett was not correct in his comments on the respective merits of a rotary-converter D.C. motor drive, and the system described in the paper. There seemed to be a considerable advantage on the rotary-D.C. motor side. Mr. Ablett talked about the rotary and D.C. motor in his system being proportioned for a fraction of the A.C. motor rating; it was a fairly large fraction, as such machines must be rated at from one-third to one-half the capacity of the main A.C. motor, according to the speed variation required. Moreover, the machines had to be built on fairly large frames, as the D.C. motor must give its full output at the minimum mill speed. The rotary converter had always to carry the full rotor current of the main motor, even when running at a speed corresponding to, say, 3 per cent. of the supply frequency, which would certainly call for a considerably larger frame than necessary for the actual KW. output on account of the heating difficulties. These drawbacks were accentuated on a 25-period supply. The advantage would be with the first system every time. Dealing with the question of relative efficiencies, there was really very little difference where only one mill was considered. Where there were two or more to be operated, there was of course a very solid advantage with the D.C. motor drive both in first cost and overall efficiency. Mr. Ablett was rather hard on the rope drive. He would certainly not put the loss at 10 per cent. There would be some gain in efficiency for the direct drive, but it was usually nothing like so great as the paper would show.

Mr. R. J. Kaula was rather surprised that the author had not made any reference to variable speed, or, rather, multi-speed, three-phase motors. A combination of cascade and pole-changing arrangements did away with a three-pulley drive with equally good results, and at the same time eliminated the complication of rotary converters described. Mr. Ablett made no reference to the power factor. Whilst the power factor had no appreciable bearing on the power consumption, it materially affected the capital cost of the installation. It would, no doubt, also have some effect on the terms obtainable from a supply authority, or on the cost of the generator, especially in the case of turbo-alternators.

Mr. H. E. Yerbury said that for rolling mills one must admit that an exceedingly good proposition could be brought forward for steam plant. He had a case in mind where the waste gases from the furnaces were utilised for the generation of steam, and where the waste gases of a lower temperature were utilised for heating the feed water. Unless electricity could be purchased or generated at less than ·5d. per unit, it would not compare favourably with modern steam or gas-driven plant for all-round efficiency with a

high load factor. From the maintenance standpoint the cost of an electrical installation would be lower than that of steam plant. Where coal could be purchased, as in Sheffield at 6s. to 7s. per ton, and gas at 11d. per 1,000 cb. ft., it would be readily seen that electricity had formidable rivals.

Mr. W. E. Burnand said the value of the electric drive, at any rate in the large powers, was to a great extent due to its being not only the most efficient but the cheapest and most readily controlled gearing between the power generator and power-using machines. Taking the case of the 12,000-H.P. motor; to get this power to the mill would be an extremely awkward job for any mechanical engineer, and he did not see how it could be done to give the acceleration and reversing powers that had been pointed out. Most rolling mills had plenty of heat going to waste that could be used for steam generation on quite a large scale at a comparatively low cost, and he thought the most advantageous way of utilising this steam would be by means of a steam turbine coupled to a homopolar generator. This was a hopeless machine for most present-day uses, but when they got up to 12,000 H.P. at turbine speeds for short-distance transmission, he thought it could easily hold the field to the exclusion of all others; 600 volts could be obtained with about four pairs of slip-rings; and whilst the design of the machine was a biggish problem to work out, it was feasible, whilst the ordinary commutator machine of that size for turbine speed most decidedly was not. With this combination of cheap steam and low cost of generating plant, he did not see how any outside supply could compete, especially as the load factor was far from good. Given a steam turbine as prime mover, and in view of the cheapness of steam in these places, the fly-wheel might with advantage be coupled to the turbine, and this allowed to vary in speed by the requisite amount to enable the fly-wheel energy to be utilised; though this reduced the efficiency of the turbine, it saved capital and complication, and some conversion losses. He thought it would pay to wind this fly-wheel with rectangular steel wire like a gun, as with the higher peripheral speed that could then be utilised, this would permit a much lighter wheel to do the work. The series system was worthy of more attention than it had so far obtained for this class of work. For instance, with a series-wound generator and motor it was possible to obtain almost any desired performance as regards speed variation between generator and motor with load, without external appliances. If both generator and motor had similar characteristic curves, they would maintain substantially the same speed relationship with varying load, precisely like two shunt-wound machines. If now the motor field was shunted by a non-inductive resistance, the speed would at first increase with increased load, and then come down to its first value. If the motor field were worked nearer saturation than the generator, the motor would increase in speed with increase of load, with constant speed on the generator, or it could maintain a substantially constant speed, with a falling speed on the generator, enabling the fly-wheel energy to be utilised without additional apparatus. An additional fly-wheel machine could be utilised just as easily as with the parallel system, the extra machine armature being in parallel with the motor armature, and the field in series.

Discussion in London.

Dr. E. Rosenberg agreed with most of the author's conclusions. He proceeded to compare the merits of A.C. and D.C. motors for rolling mill work, and mentioned that the author appeared to prefer an arrangement of A.C. motor, rotary converter, and D.C. motor in cascade, to the use of a D.C. motor on the mill, supplied direct by a rotary converter. He could not follow the author's reasons, and did not think the arrangement would be so efficient, except in the case of smaller variations of speed than usual.

Dr. Wiesengrund referred to the possibility of employing an efficient mechanical drive, with gearing between motor and mill; there were many cases where the overall efficiency with such an arrangement would be better than for a direct drive, particularly where slow-speed mills were employed. He illustrated a 350-H.P. geared drive with a motor flexibly coupled to a fly-wheel, the latter being flexibly coupled through double helical gearing to the rolls. The speed reduction was 10 to 1, and a much smaller fly-wheel was required. He advocated such drives up to 1,500 H.P., pointing out that gearing had been produced with an efficiency of 98 per cent., and that the higher-speed motors employed also had a better efficiency.

Mr. Howard suggested the use of one pair of rolls only for roughing and finishing, as was common practice in America.

Mr. R. Borlase Matthews said that tinplate and bar rolling-mill drives presented a difficulty owing to the frequency of the passes; with the old steam drive the mill often lagged behind the men, but with the electric drive the mill speed had to be kept down. He did not believe that the S. Wales tinplate manufacturers would agree that the American system was better than their own. The author apparently credited the rope drive with greater losses than it actually had; it had proved a very useful method of driving. The author also favoured the D.C. motor, while in America the induction motor was preferred.

Mr. J. Fasola suggested that an improved efficiency would be obtained by using cascade motor drives, when the two and three-speed features could be utilised. Such motors would have a higher power factor than induction motors; the power factor of slow-speed motors was relatively very poor, and this was one reason why high-speed motors and geared drives had been used. He concluded by emphasising the smaller cost and efficiency of a cascade motor driving equipment as compared with a drive involving A.C.-D.C. converting machinery.

Mr. G. C. Allingham referred to the possibilities of the storage battery for load equalising. For regular cyclic variations, the fly-wheel was the best equaliser, but, for irregular variations, the storage battery was better, and it had the advantage in capacity and no-load losses. The slip regulator involved a considerable waste of energy, and the mill output was reduced at reduced speeds.

Mr. A. Williams agreed with the author in preferring the direct drive. With high speed drives the gearing and bearings gave trouble. The C.M.B. system had been adapted for rolling mill driving, and it did away with slip resistances, &c., giving an improved efficiency at low speeds.

The Author then briefly replied to the various points raised.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

We have received the following report of the annual general meeting of this Association, which was held at the office, 36, Kingsway, London, W.C., on Thursday last week. About 50 members were present, Mr. F. H. Nalder, chairman of the Council, presiding.

Before moving the adoption of the report and balance-sheet to September 30th, 1911, the chairman referred briefly to the work of the reorganisation of the Association, which, he said, had necessarily occupied much of the time and attention of the Council during the period under review. Members could see before them, in the room where they were sitting, a small part of the results attained. They now had offices and a staff which, he thought, could be regarded as worthy of the industry and of the Association representing it. They had to thank the retiring Council, as a whole, for that work. Their time and energies had been freely given to it. But it could not have been done at all without the support of the great body of manufacturers, and in the necessary work of putting before manufacturers the advantages of possessing such an Association, no one had done better service, or met with greater success, than his friend, Mr. Longbottom (Electromotors, Ltd.), the vice-chairman of the Council. As a result of their efforts, whereas a couple of years ago they had 40 members, they had last year doubled the number, and now the list was but a few units short of 100, and it was steadily increasing. They were not going to stop at that. To make the Association a thoroughly strong organisation, they needed every electrical manufacturer and his allies, and they expected and invited the whole industry to come in.

The other subject which had made inroads upon the energies of the Council and the work of the Association was the Electrical Exhibition promoted by themselves and held at Olympia during September and October last year. That Exhibition had certainly been a financial success. He believed the report referred to the good-tempered, if severe, criticism levelled at it by the Press. They would profit by what had been said, and he hoped that their next exhibition would be an improvement in every way. While on that subject, and in view of members wishing to raise the question, he might say that the Association had for some time found it necessary to set its face against the lavish promotion of exhibitions. The industry had been almost submerged with applications from all sorts of people for support for all sorts of schemes, and had in the past even spent a great deal of time and money without any adequate return. They did not discountenance large and creditable undertakings promoted by such people as the supply authorities; and one such Exhibition—the forthcoming Smoke-Abatement Exhibition—they were recommending those of their members who were specially interested, to support. Considering the activity of the gas interests and the public interest in the smoke-abatement question, they could not afford to neglect such Exhibitions. The secretary would make a statement in this connection.

Turning to the internal business of the Association, he would particularly like to refer to the work of the Sections, into which, for better division of labour, the Association was divided, and within which the main work of the Association was carried on. He said that members who took part in those Sections would appreciate the value of the work done in them. Their proceedings were not for general publication.

Equitable conditions of contract was another important subject which had long occupied their attention, and the Institution of Electrical Engineers had given them an opportunity of submitting proposals in regard to the *Model General Conditions of Contract*, of which they had availed themselves, and they would shortly be in a position to lay their suggestions before the Parliamentary Committee of the Institution.

The subject of electrical standards was also engaging their attention. He must not, however, occupy their time with a detailed catalogue of what had been done and what still remained to be done before they could feel that they had fully vindicated their position. Members would, no doubt, wish to raise some questions on the report and accounts. They would notice that a somewhat small balance had been carried forward from the period preceding the reorganisation. They were now, he was happy to say, in a very different financial position. He moved the adoption of the report. The motion was seconded by Mr. Longbottom.

Mr. Justus Eck (Union Electric Co., Ltd.) expressed the hope that in the final distribution of the Exhibition surplus the Electrical Trades Benevolent Institution would benefit.

On the motion of Mr. A. B. Anderson (Ferranti, Ltd.) the matter was referred to the new Council.

On the invitation of the chairman the meeting then proceeded to the election of the Council, and the result of the ballot was declared as follows: Belliss & Morcom, Ltd.; British Thomson-Houston Co., Ltd.; British Westinghouse Electric and Manufacturing Co., Ltd.; Browett, Lindley & Co., Ltd.; Dick, Kerr & Co., Ltd.; D.P. Battery Co., Ltd.; Electromotors, Ltd.; Elliott Bros.; Ferranti, Ltd.; General Electric Co., Ltd.; Lancashire Dynamo and Motor Co., Ltd.; Nalder Bros. & Thompson, Ltd.; Siemens Bros. Dynamo Works, Ltd.; Vickers, Ltd.; Willans & Robinson, Ltd.

After the election of Messrs. Price, Waterhouse and Co. as auditors for the year, the secretary stated that arrangements had been made between the supply authorities and the manufacturers for a joint exhibit at the forthcoming Smoke-Abatement Exhibition, on conditions more favourable to the latter than had hitherto existed. A meeting of manufacturers, specially interested in lighting, heating and cooking apparatus, would be called at an early date to go into the business, and he expressed the hope that any manufacturers of such apparatus still outside the Association would make it their business to communicate with him.

The secretary then dealt at some length with the sectional and other activities of the Association, and a vote of thanks to the chairman for his work during the year, proposed by Mr. Anderson, having been carried unanimously, the proceedings terminated.

The Council of the Association have fixed Thursday, February 15th, for their first meeting.

NEW POWER STATION AT BURY.

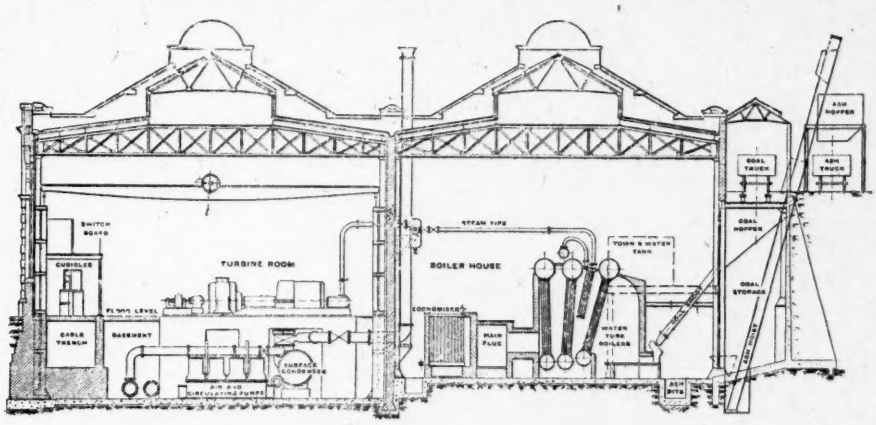
From time to time we have referred to the progress made with the new Chamber Hall power station of the Bury Corporation, which was to have been officially opened on January 10th last.

The site of the station adjoins the Lancashire and Yorkshire Railway, in connection with which there is a double-track coal siding for supplying the bunker; the site is also adjacent to several large reservoirs covering seven acres, and supplied from the River Irwell, which, by arrangement with the occupiers, have been made available for condensing purposes at the power station.

The buildings, which have been constructed in local bricks on concrete foundations, comprise a turbine room 69 ft. wide and a parallel boiler house, 64 ft. wide, both being 104 ft. long; the buildings are steel framed, with roofs carried on lattice girder principals.

The boiler house at present contains three "Woodeson" boilers, and space is left for a fourth between those installed and a 200-ft. chimney, which will ultimately occupy the centre of a range of eight boilers.

The boilers each have an evaporative capacity of 25,000 lb. of water per hour at 200 lb. pressure, and by means of superheaters 150° F. can be added to the steam temperature.



Cross Section, Chamber Hall Power Station, Bury Corporation.

Mechanical stokers of the coking type are fitted, the hoppers being fed through spouts from steel bunkers, which in turn are fed from coal wagons on the siding above.

The steel bunkers have a capacity of 100 tons, but the space below them to the boiler house floor level gives an additional 650 tons storage.

The ashes are raked out of the dumping pits into a skip, operated by an electric crab on a runway over the firing floor, by means of which and a hoist, the ashes can be lifted into a hopper over the railway siding.

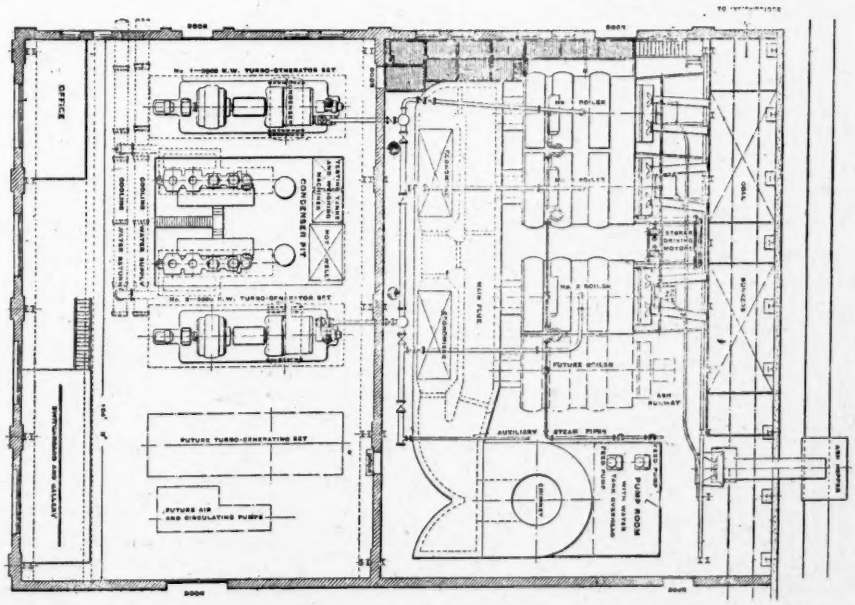
A 480-tube economiser arranged in two parts is situated behind the boilers; feed pumps, two in number, of the "Woodeson" type each of 100,000 lb. capacity, are provided in the boiler house drawing their supply from either a 16,000-gallon town water storage tank or (usually) the hot-well in the engine-room basement.

The engine room plant consists of two 2,100-kw. three-phase turbo-alternators generating 50-cycle current at 6,000/6,600 volts. These sets were supplied as to the turbines, which are of the Zoelly type, and condensing plant by Messrs. Musgrave, and the electrical plant by Messrs. Siemens.

The turbines are fitted with speed limiting gear on the governor, motor-driven oil pumps for flushing the main bearings before starting up, motor-driven governor regulating gear controlled from the main switchboard, and motor-operated 48-in. exhaust valves between turbines and condensers.

The governor is capable of holding the speed to within ½ per cent. for normal load changes; the runaway attachment to the governor comes into use if the speed increases 10 per cent. above the normal.

The efficiency of the alternators on an inductive load with power factor ·8 is 91 per cent. on full load, 89·5 per cent. for three-quarter, 85·5 per cent. for half, and 75 per cent. for quarter load. Special air circulation is provided, approximately 8,000 cb. ft. per min. being circulated through each machine.



Plan of the New Chamber Hall Power Station, Bury.

The condensers are of the surface type, and the air and circulating pumps, of the steam-driven reciprocating type with two 23-in. diameter Edwards air pumps, two 18-in. diameter double-acting circulating pumps and a compound engine, all driving one crankshaft, the H.P. and L.P. cylinders of the engine being at opposite ends. Two fly-wheels are provided, and two smaller pumps are operated by suitable motion from this plant.

The L.P. exhaust steam is passed through a Baker oil separator

and thence to the L.P. end of the turbine. To enable continuous steam consumption tests to be carried out, two galvanised tanks on weighing machines are provided, into either of which the air-pump discharge can be diverted by suitable three-way valves.

The extra-high-tension switchgear, by Messrs. Ferranti, is arranged in cubicles at engine-room floor level, with an operating gallery overhead. The switchgear is divided equally by a centre cubicle containing a large capacity bus-bar dividing oil switch, and each half controls one generator, two-feeder circuits, and a station circuit, while spare cubicles are provided for additional two-generator and two-feeder switches.

The switches for the generators, station circuits, and bus-bar dividers are hand-operated only, but the feeder oil switches are fitted with adjustable overload time limit trip gear.

As the neutrals of the generators are not connected to earth, three earth indicating voltmeters have been provided. The feeder cables (by Messrs. Siemens) running from the new station are in duplicate, of the three-core type, with 15 sq. in. conductors, paper insulated, lead covered and wire armoured, laid in Howard troughing, and supply a sub-station at the old Rochdale Road works.

The switchgear installed is similar to that in the power station, and controls three feeders and three motor-generators, one of the feeders supplying through transformers to an adjacent factory.

The motor-generators are each of 500 KW. capacity and G.E.C. manufacture, with interpoles on the D.C. side. They are started up from the D.C. bus-bars, and can be used reversed, if necessary, to supply A.C. The machines give their full output when working either at 440-480 volts or 500-550 volts.

The power station was designed by, and erected under the supervision of, Mr. S. J. Watson, the borough electrical engineer, to whom we are indebted for these particulars.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,693. "Electric clock mechanism for time switches and other purposes." F. T. Reid. January 22nd.

1,698. "Means for the manufacture of bushes or bearings for shafts, axles, self-propelled vehicles, engines, electric motors or the like." W. G. Hanna, jun. January 22nd.

1,721. "Telephones." F. C. Shardlow. January 22nd.

1,724. "Accessories for vapour, gas and the like lamps, gas brackets, gas pendants, hall light pendants, kitchen pendants or electric lamps and the like." A. C. Dainesi. January 22nd.

1,753. "Electrical systems for automobiles." J. Bijur. (Convention date, February 2nd, 1911, United States.) February 22nd. (Complete.)

1,755. "Feeding mechanism for the electrodes of electric arc lamps." F. Steinert. January 22nd. (Complete.)

1,817. "Electric switch mechanism." J. W. Record. January 23rd.

1,829. "Electrically-driven hydraulic lifts." E. M. T. Boddam. January 23rd. (Complete.)

1,889. "Induction furnaces." H. G. Solomon. (Addition to No. 903, of 1911). January 23rd.

1,852. "Electric tablet systems for working single lines of railway." A. T. Blackall and C. M. Jacobs. January 23rd.

1,861. "Electric synchronisation of clocks by signals from observatories or distributing centres." W. J. Polyblank. January 23rd.

1,864. "Electrical condensers." Marconi's Wireless Telegraph Co., Ltd. January 23rd.

1,871. "Integrating electric meters." S. G. S. Dicker. (Chicago Electric Meter Co., United States.) January 23rd. (Complete.)

1,888. "Incandescent electric lamps." F. S. Dinenage. January 24th.

1,901. "Hunting gear for electrically controlling guns on ships and ashore, steering gear on ships, swing bridges, hydraulic accumulators, cranes, capstans and the like." A. Martin, H. Jackson, A. J. Campbell, T. B. Campbell and W. Campbell. January 24th.

1,902. "Socket connectors for electrical cooking utensils." D. S. Munro. January 24th.

1,923. "Electric switches and cut-outs." F. Shepherd and I. Levy. January 24th.

1,957. "Distributors for magneto-electric machines." C. Parrot. (Convention date, May 18th, 1911, Belgium.) January 24th. (Complete.)

1,961. "Linings or coverings for electrical furnaces." Soc. Generale des Nitrures. (Convention date, January 26th, 1911, France.) January 24th. (Complete.)

1,965. "Apparatus for the control of electric circuits." H. Leitner. January 24th.

1,968. "Blackleading machines for the use of electrotypers." R. Hoe and Co., Ltd., and F. Grafton Lougee. January 24th.

1,969. "Blackleading-machines for the use of electrotypers." R. Hoe and Co., Ltd., and F. Grafton Lougee. January 24th.

1,979. "Control of alternating-current electric motors." E. Rosenberg. January 24th.

1,980. "Electric arc lamps." E. E. Prestwich. January 24th.

1,983. "Electric heaters for liquids." J. P. Bland and E. G. Simester. January 24th. (Complete.)

1,999. "Dynamo-electric machinery." H. C. Siddeley. January 25th.

2,001. "Multiple contact in the thermo-electric elements." P. Ferra. January 25th.

2,020. "Spring shade-holder for electric lamps." J. S. Munro, jun. January 25th.

2,028. "Electric surface resistances." C. A. Allison (Compagnie de L'Industrie Electrique et Mecanique, Switzerland.) January 25th. (Complete.)

2,040. "Gas-electric trains." R. F. Millane. January 25th.

2,042. "Speed control of direct-current series electric motors." Siemens Bros. Dynamo Works, Ltd., and F. Lydall. January 25th. (Complete.)

2,048. "Shade carriers for electric incandescent lampholders." A. P. Tullett. January 25th.

2,049. "Electric telegraphy." A. Muirhead and Muirhead & Co., Ltd. January 25th. (Complete.)

2,068. "Means for heating liquids by the aid of electricity." C. W. Rafferty. January 25th.

2,081. "Electric metallurgical furnaces." V. Stobie. January 26th.

2,098. "Electric heating apparatus." F. B. Cox. January 26th.

2,124. "Electrolytic apparatus." L. H. A. B. M. Hazard-Flamand. (Convention date, February 6th, 1911, United States.) January 26th. (Complete.)

2,125. "Means applicable for use in controlling the transmission of rotary motion." Peto & Radford, Ltd., and H. M. Genese. January 26th.

2,126. "Electric plug connectors." W. Peto and Peto & Radford, Ltd. January 6th.

2,155. "Process for the manufacture, isolation, and enrichment of radium and other radio-active substances." G. Eblen. (Convention date, March 6th, 1911, Germany.) January 26th. (Complete.)

2,159. "Filaments for electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) January 26th. (Complete.)

2,160. "Power-transmission devices." E. S. Louis. January 26th.

2,180. "Mechanical and electrical interlocking gear for the shafts or cage gates or doors of lifts." W. Reid. January 27th.

2,183. "Suspensory anti-vibrators for metallic-filament lamps." Maxwells (Dundee), Ltd., and S. Ponsford. January 27th.

2,205. "Electric light and other like fittings." C. J. Thursfield. January 27th.

2,216. "Electric clock systems." A. R. Upward. January 27th.

2,221. "Electrically heated flat-irons." K. Kaltschmid., jun. January 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Wall-Plugs and Sockets. R. Hirst and N. Chapman. 8,875. April 5th.

Electric Switches. British Thomson-Houston Co. (General Electric Co.) 10,254. April 27th.

Switch-Holders for Electric Incandescent Lamps. A. V. Downton and A. R. Kibblewhite. 10,527. May 1st.

Electric Radiation Furnaces. E. C. R. Marks. (Geb. Siemens & Co.) 11,992. May 17th.

Conductor Points of Electric Railroads on the Overhead Conductor System. A. Nicholson and N. Nicholson. 13,970. June 8th.

Apparatus for Sterilising Liquids by means of Ultra-Violet Rays. Soc. Anon. Française Dite Banque du Radium. 15,010. June 27th. (October 15th, 1910. Addition to No. 14,912 of 1911.)

Liquid Electric Controllers. Allen, West & Co. and R. Moggridge. 16,871. July 24th.

High-Pressure Current Distributors for Electric Ignition Apparatus. W. Heyer. 16,968. July 24th. (July 28rd, 1910.)

Electric Alarm Clocks. F. Goss. 17,051. July 25th.

Make-and-Break Device for the Primary Circuit of Electromagnetic Ignition. W. Heyer. 17,053. July 25th. (July 25th, 1910.)

Electric Horns. E. Lucas and R. Edwards. 19,035. July 28th.

Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 19,187. July 28th. (August 27th, 1910.)

Electrically-Controlled Railway Signals and the like. Siemens & Halske Akt.-Ges. 21,873. October 4th. (November 4th, 1910.)

Automatic Regulating Apparatus for Electric Supply Systems. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 24,105. October 31st.

Means for use in Automatically Regulating the Timing in Magneto-Electric Apparatus. H. Wiehl. 24,970. November 9th. (November 9th, 1910.)

Controlling Mechanism of Alternating-Current Arc Lamps. A. Ogilvy-Webb, H. J. Booker and R. C. A. Reinecke. 46. January 2nd.

Electric Generating Systems of Vehicles, particularly for Lighting-up Motor-Cars. W. Seal. 452. January 7th.

Galvanic Batteries. A. Heil. 473. January 7th. (March 14th, 1910. Addition to No. 207 of 1911.)

Electric Motors and Pumps connected thereto. Gwynnes, Ltd., J. F. Breeze and R. Macdonald. 694. January 9th.

Electric Motor Reversing Switches. V. Stobie. 672. January 10th.

Apparatus for Heating Air or other Media by Means of Electricity. C. G. Bell. 683. January 10th.

Electric Transformers. British Thomson-Houston Co. (General Electric Co.) 711. January 10th.

Vacuum Tube. R. Whiddington. 1,292. January 17th.

Boxes for use with Electric Cables, Telegraph, Telephones and the like, applicable also for other purposes. H. Dickinson. 1,802. January 18th. (Cognate application, No. 5,745 of 1911.)

Wall-Box with Adjustable Cover for containing Electrical Switches and Plugs and the like. J. W. Brooks and A. E. Read. 1,699. January 23rd.

Polyphase Alternating-Current Dynamo-Electric Machines of the Commutator Type. Allgemeine Elektricitäts Ges. 1,942. January 25th. (January 26th, 1910.)

Resistances for Electrical Heating and Cooking Apparatus and other purposes. G. Cooper. 3,745. February 14th.

Circuit Connections for Electric Current Distribution with Auto-Transformers. F. Kesselring. 4,618. February 23rd.

Manufacture of Metal Tube particularly of use as an Electrical Conduit. J. Evans. 6,460. March 15th.

Electric Lighting Arrangements for Billiard Tables, Shops and the like. H. Mitchell. 7,344. March 24th.

Sparking-Plugs for Internal-Combustion Engines. N. Player and B. Hill. 7,789. April 3rd.

Electric Time-Switches. J. G. Mehne. 11,288. May 9th. (Patent of Addition not granted.)

Combustion Bridge for Arc-Light Electrodes. R. W. James. (Ges. für Verwertung technischer Patente.) 11,486. May 11th.

Electromagnetic Ignition Device for Internal-Combustion Engines. A. Ritter. 12,869. May 22nd.

Switch for Electric Illuminating Devices. C. Graebe and C. Lehrbach. 13,341. June 2nd.

Construction of Magneto-Electric Ignition Machines. Firm of Robert Bosch. 13,705. June 3rd. (August 27th, 1910.)

Electrical Wall-Sockets and the like. R. Tucker. 14,110. June 20th.

Process and Arrangement for Forming an Electrical Arc. B. Duschnitz. 16,902. July 23rd. (July 29th, 1910.)

Holders for Electric Lamps. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 17,869. August 5th.